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JANUARY 5, 1942
VOLUME 31, No. 1

AMERICAN DYESTUFF REPORTER

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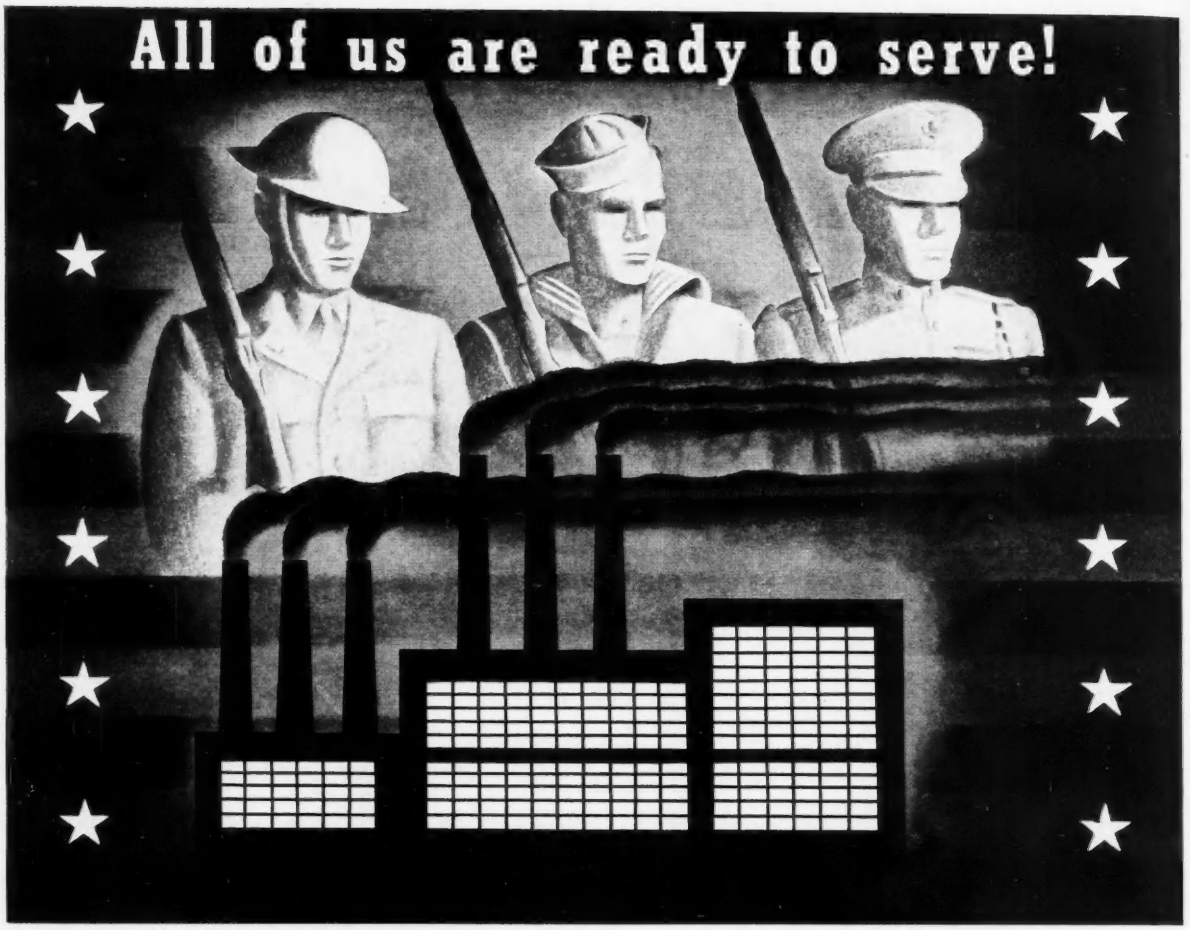

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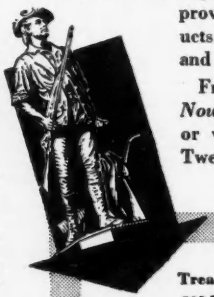

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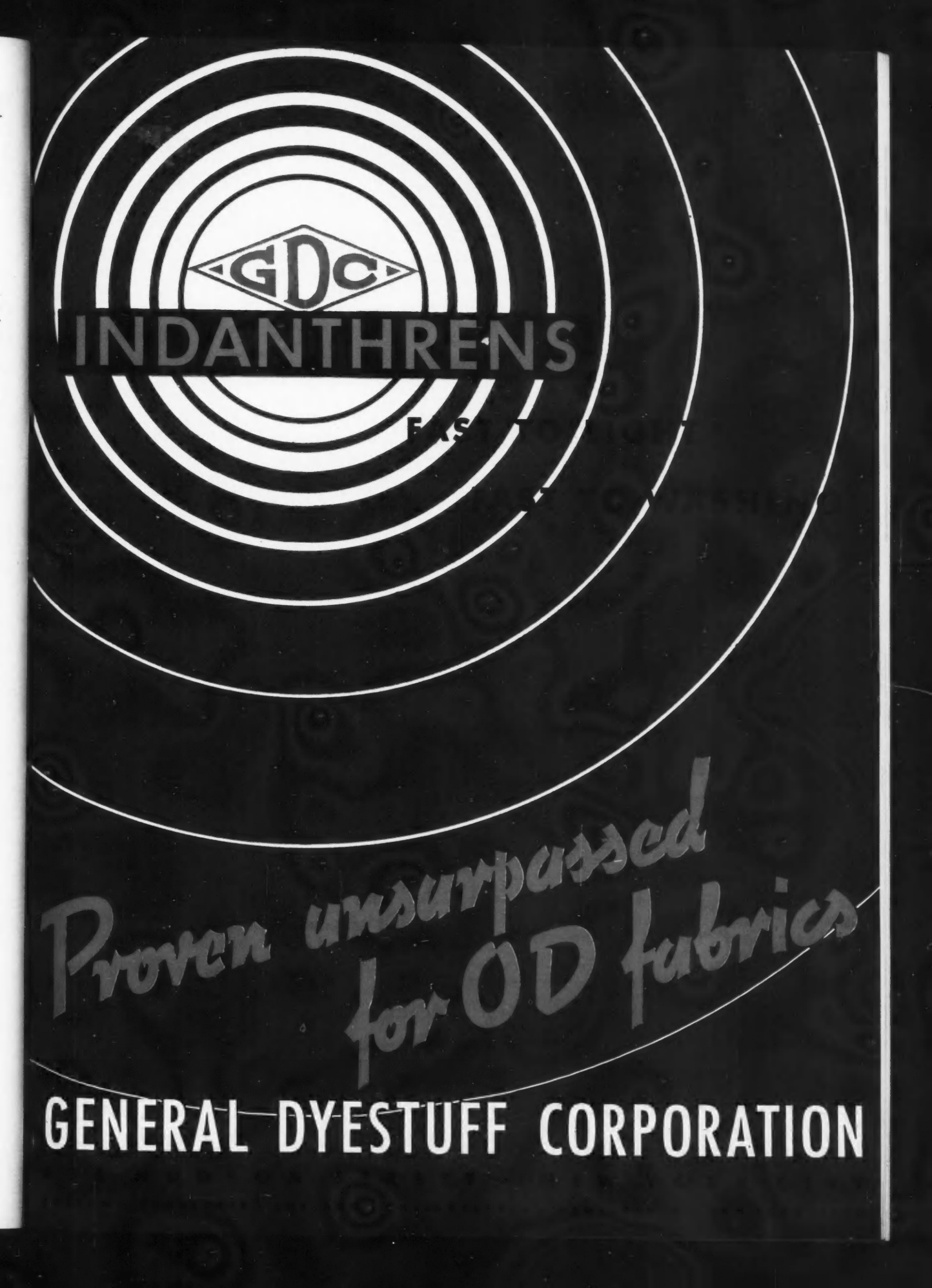
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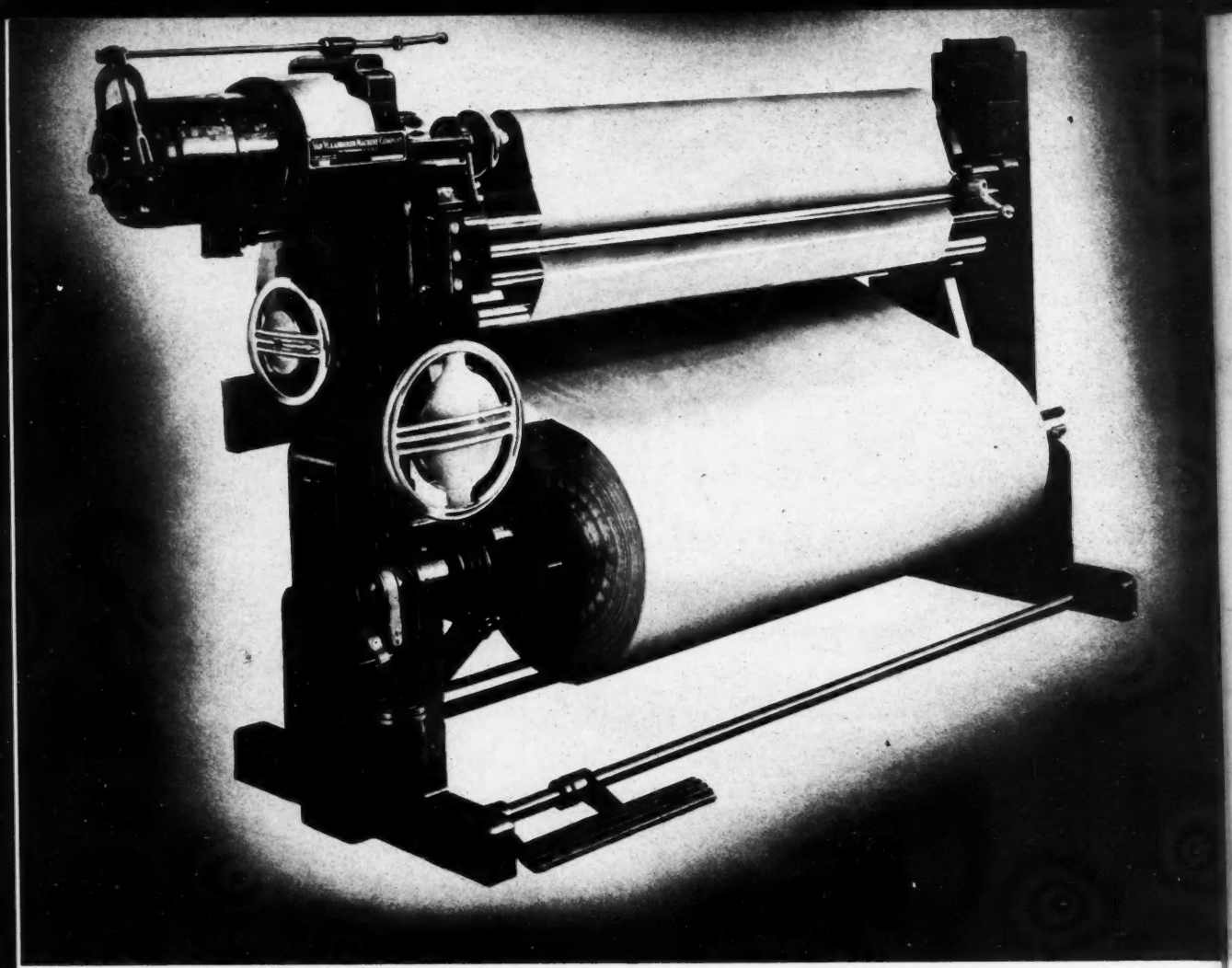

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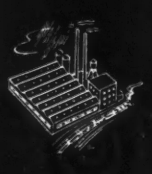

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JANUARY 5, 1942

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JANUARY 5, 1942

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CALENDAR of Coming Events

Meeting, Philadelphia Section, Hotel Philadelphian, Philadelphia, Pa., January 9, 1942. Speaker: Dr. M. E. Heard, Dean of Philadelphia Textile School, "Textile Education."

Meeting, Northern New England Section, January 16, 1942.

Meeting, New York Section, January 23, 1942, Chemists' Club, New York, N. Y.

Meeting, Piedmont Section, Poinsett Hotel, Greenville, S. C., January 24, 1942.

Meeting, Mid-West Section, Bismark Hotel, Chicago, Ill., January 31, 1942.

Textiles and National Defense—

Purchase and Inspection of
TEXTILES FOR THE ARMY

LIEUT. COLONEL VERE PAINTER, QMC, PQMD

LAST year when I addressed your Convention in New York, I started my talk by stating that I represented the World's largest purchaser of textiles and then proceeded to tell you how we had purchased during the first four months of this emergency some 50 million yards of cloth. To me, and I believe to you, that figure represented a very large quantity of textiles; in fact, the quantity was so large that I was not at all sure we were going to be able to properly handle the inspection of all the cloth in the time available.

We not only did handle the receipt and inspection of 50 million yards of cloth but during the Fiscal Year ending June 30, our purchases amounted to very near 500 million yards of cloth, so I do not hesitate to say that I still represent the World's largest textile buyer—the United States Army, and specifically the Philadelphia Quartermaster Depot, which purchases 90 per cent of the clothing and textiles required for your Army.

Most of the cloth purchased prior to June 30, this year, has been converted into pants and coats for soldiers and your Army today is not only the best clothed Army in the World, as it has always been, but it is better clothed today than it ever was before. In fact, we have so many different kinds of clothing and textile equipment these days that I must confess I have great difficulty in keeping track of it all. Sometime ago it was discovered that we had adopted as absolutely necessary to National Defense some seventeen (17) different kinds of hats and caps for the Army and a Board of Officers was appointed to see if they could not reduce the number of different kinds of headgear required; after discussing the problem at great length a member of the Board suggested they sum up their action and see what had been accomplished. They did this and to the amazement of all they discovered that they had not only failed in their mission but had added another type of hat to those already required. This reminds me of the old Army saying that all boards are alike —long, narrow and wooden.

The purchase of this large quantity of textiles and the conversion of the cloth into garments has not been accomplished without difficulties, both foreseen and unforeseeable. These difficulties have ranged all the way from minor changes in specifications to changes in National policies. Naturally, the foreseeable difficulties had been planned for prior to the emergency and we were ready with the necessary changes as the necessity therefor arose. The unforeseeable difficulties have been the ones that have kept us burning the midnight oil.

Early in the emergency our problem was principally that of personnel expansion and obtaining the trained technologists to properly inspect the materials we were buying. During World War. No. 1, I was a doughboy, plodding through the mud and all I knew about procurement of textiles and clothing during that period is what I have been told and my personal observation of the clothing that was issued to the soldiers. From the looks of some of that clothing I can readily believe some of the stories about boiler-makers having been assigned to inspect textiles and textile inspectors being assigned to drive mules and I do not mean the kind of mule the spinner cusses so much.

I can truthfully say that so far in this emergency we have not assigned a textile inspector to a mill without that inspector having at least a fair knowledge of the manufacture of the product he was to inspect.

Frequent changes in policies and purchasing procedure, mostly initiated by those who were not altogether familiar with the problem, caused considerable confusion and sometimes delay and I must confess that at times there were what appeared to be attempts by interested individuals and groups of individuals to influence our action to their advantage. We believe that we have successfully handled these obstacles and that in spite of everything this enormous procurement has been carried out in a manner that cannot be criticized to any great extent.

Prior to the beginning of the emergency we purchased all textiles and clothing f.o.b. the receiving depot. This did, at times, make it very difficult for the manufacturer, whose plant was located at a considerable distance from the receiving depot, to compete with one that did not have to ship his product so far. While this limited competition somewhat, it was justified by being the most economical method of purchasing. Shortly after the beginning of the emergency we began to purchase everything f.o.b. the point of manufacture, and then shipping it at Government expense to the receiving depot. This broadened our source of supply considerably and eliminated the advantage that had been enjoyed by the nearby manufacturers.

The urgency of the situation resulted in our being forced to specify some delivery schedules in the early days of the emergency that were almost impossible to meet but on the whole our requirements were met on time and when the

NOTE: *Other papers presented in the Session on Textiles and National Defense at the Annual Meeting in Pinehurst, N. C., on November* 1, 1941, *were published in the December* 22, 1941, *issue.*

first men started to arrive in the training camps they had sufficient clothing and textile equipment to take care of them. However, there were times when we were not sure which would arrive in camp first, the soldier or his pants.

Our specifications had been so drawn as to provide the soldier with the highest quality of garments, consistent with a reasonable price and our first purchases during the emergency specified the same high quality fabrics. It soon became evident that we could not obtain requirements of certain cotton fabrics without some lowering of quality. However, it was resolved that we would not lower our standards any more than absolutely necessary and we have stuck to this resolution so far.

One of the first bottlenecks we encountered was the fact that combed plied yarns could not be produced fast enough to meet our requirements. This was especially true with our cotton uniform twill and the herringbone twill we used for work garments. Th standard khaki twill was a two-ply, combed warp and filling and the herringbone twill was a combed yarn fabric.

In order to obtain our requirements of the uniform twill, we specified three alternate fabrics: One, a two-ply warp and a single filling combed yarn fabric; another a carded single. Both of these were of the same high texture as the standard fabric but strength was reduced correspondingly and appearance suffered to some extent. The third alternate twill purchased was of a lower texture than the standard or the other two alternates but made an excellent substitute when used for certain purposes. The standard herringbone twill was changed from a combed yarn fabric to a carded fabric.

In purchasing our uniform twill preference has generally been given to the standard fabric and the substitutes have only been purchased when necessary. The changes in the specification have so far been sufficient to meet our requirements although some additional changes may be necessary soon on the account of a possible shortage of long staple cotton of a suitable grade.

In October, of last year, we were suddenly faced with the problem of obtaining a very large quantity of a highly wind resistant, water-repellent, fabric of light weight and low bulk. Investigation revealed the fact that the most suitable fabric available was a high-texture twill of plied combed yarns. However, this fabric was not available in sufficient quantities to meet our needs and a substitute was required immediately and, without much investigation or experimentation, we selected as the first alternate a 2 x 1 combed poplin with a slightly higher pick count than was used commercially. These two fabrics have proven to be the best fabrics for use in field jackets and other garments where a high degree of wind resistance is required.

Once the fabric has been selected for field jackets we were faced with the problem of obtaining a permanent water-repellent finish on the fabric, for the soldier in the field certainly needs clothing that will shed water without losing its water-repellency at the same time. Unfortunately, at that time, there was only one water-repellent treatment that could be classed as permanent, that treatment was very expensive and had some undesirable characteristics. Some of you made attempts to obtain permanent water-repellency with other treatments but were not altogether successful and to date we are still looking for another permanent water-repellent treatment equal to the one we have been using.

The use of permanent water-repellent treatments has increased so rapidly during the past year that some difficulty has been experienced in obtaining sufficient chemicals to meet our needs and if our demands increase much more we may not be able to meet them unless some of you chemists can develop additional satisfactory treatments.

In the early days of the emergency we had a very difficult time in obtaining sufficient raincoats to meet our needs. Our standard coat was a rubberized coat made of two pieces of very fine handkerchief lawn, rubberized and vulcanized together. The capacity to produce this coat was limited by the fact that it required a very high quality fabric and expert workmanship. As a substitute we had an oiled balloon cloth coat that made a very satisfactory garment except that sometimes it would stick together so bad as to make the coat useless. As far as I know, none of the chemists have been successful in overcoming this defect.

Some experiments have been made with other types of raincoats but none have been satisfactory and the standard raincoat today is a rubberized coat. However, we have discontinued the use of the fine lawn and are now using fabrics that are much more readily obtainable.

Tentage has presented a very big problem, both from the standpoint of obtaining grey goods and the finishing. Sufficient twisters are not available to turn out all of the plied yarns required and neither are there sufficient heavy looms available to meet our requirements.

The waterproofing of tent duck has never been satisfactory and efforts are being made to obtain better fire, water and mildew resistance than has been possible heretofore.

Sometime ago the War Department adopted a standard olive drab shade for use on cotton goods such as duck. This standard is such that it cannot be obtained by the use of mineral dyes and if we are to continue to require this shade it will be necessary to use vat dyes or sacrifice fastness and go to sulfur dyes, with the resulting uncertainty as to the possibility of deterioration by the reason of the formation of sulfuric acid.

As you may have gathered from my talk, so far, most of our trouble has been with cotton textiles. Woolens and worsteds have presented very few difficulties and with the exception of some work that is now in progress toward developing dye combinations that are faster to light, we are not having as much difficulty as we had a few years ago.

One thing that I cannot impress too strongly upon those

(Continued on page P16)

Textiles and National Defense—

Textiles from the NAVY STANDPOINT

LIEUT. R. G. BUCK, SC. USN

The opinions expressed herein are those of the writer and are not necessarily those of the Navy Department.

TEXTILES from the Navy standpoint covers a very broad field. I shall confine myself somewhat to the textiles we use at the U. S. Naval Clothing Depot, Brooklyn, New York.

The U. S. Government, through its various agencies, is the largest buyer of textiles today. In nearly all cases either Federal or Department specifications are used. We at the Naval Clothing Depot use nearly 50 Federal specifications and 150 Navy Department specifications in the procurement of textiles. These include material made of wool, cotton, silk, mixtures, rayon and other substitutes; included are buckles, buttons, braid, tape, thread, and other textile trimmings; also there are specifications for completed garments from hats to shoes, inner and outer garments.

These specifications are for the mutual benefit of the government and supplier. The government knows what is desired and specifies in detail that which is wanted. The supplier knows exactly what he is bidding on and what he will be required to furnish, in competition with other potential suppliers.

The purchasing of textiles that enter into the construction of Naval uniforms is accomplished through the use of sealed bids. At a definite time, stated in the invitation to bid, all bids are opened. Shortly thereafter an award is made to the lowest bidder complying with all the conditions of the sealed bid, after which a contract is drawn up and signed by both parties.

In most instances, the quantity of textile material to be purchased is large. Competitive conditions may be such that at times the quantity is divided among several contractors. Upon receipt at the Naval Clothing Depot it is amalgamated into common stock.

It has been said, and truthfully so, that the enlisted men of the United States Navy are the best dressed sailors in the world. We believe that this includes the design or cut of uniform, the quality of the material used, and the uniformity of appearance. It is our job to keep them so uniformed.

It must be borne in mind that Naval units will have in their assembled groups, sailors with a few months' service to those having up to 20 years' service. There will be sailors who have just been transferred from one station to another. However, no matter their length of service, or where they are, their uniforms must and will look alike.

The adoption of all Naval materials has been through the trial and error method, i.e., different fabrics of known properties were produced by competent mills, were made into garments and subjected to actual field tests. After a definite period they were recalled, analyzed, and compared, with consideration given to the attached reports noting vital information as to length of time worn, under what conditions, the recommendation made, etc. Upon adoption of the most qualified fabric, the mill men were again called in to aid in the formation of the governing specifications to assure an adequate supply under competitive bidding. Standard samples were then made up, approved, and placed on file. The standard samples are used as the manufacturer's yardstick and the basis of comparison for all deliveries.

For illustration, I should like to briefly discuss the two fabrics of which we use the most yardage. These two are the 16-ounce dark blue melton, a woolen fabric; and the bleached twill, a cotton fabric.

The Naval service uses the wool fiber processed on the woolen system for 95 per cent of its fabrics, in preference to the worsted. It is considered that the characteristic woolen fabric is more adaptable to the difficult stowage and cleaning problems encountered aboard ship. Men stow their folded uniforms in rather small lockers. As for cleaning and upkeep, the enlisted man at times washes his uniform, dries it, then neatly folds and stows it in his locker. It is felt that a worsted fabric given the same treatment would present a poorer appearance much sooner than a woolen fabric. The difference in price further justifies the use of woolen fabrics.

Our 16-ounce dark blue melton is used for the enlisted man's trousers, dress jumper, and blue cap. Specification requirements are that the stock used must be fleece wool of a grade not lower than 64s (U. S. Standard). The weave must be a two up and one down twill to the right, the weave being specified to obtain uniformity. The fabric construction shall contain not less than 62 ends per inch in the warp, and not less than 56 picks per inch in the filling, which assures us of a tight or firm fabric. The breaking strength, as measured by the grab method, shall be not less than 62 pounds in the warp and 50 pounds in the filling, which gives us a strong fabric. The elongation shall be not less than 0.60 inch warpwise and 0.80 inch fillingwise. The width shall be not less than 55 inches exclusive of selvedges. The weight shall be not less than 15½ ounces nor more than 16½ ounces per linear yard exclusive of selvedges, which is lighter in weight than the more commonly known commercial melton. The Navy melton has been found to be the

most serviceable for present Navy use, having sufficient body without too much boardiness. It is not too heavy, yet highly wind resistant and warm. It also presents a satisfactory appearance at all times. The dyeing and dyestuffs, in which you are more interested, is specified to be stock dyed; bottomed with alizarine and a chrome mordant; and then dyed with indigo. The proportion of the dyes as specified must be such as to produce the color of the standard sample. It must be understood that the color match of the standard sample is vital for the reason of uniformity of color. When sailors are lined up on board ship for inspection, there are many men wearing the identical cut and color of garment, and any slight deviation in color immediately becomes distinguishable even to the inexperienced eye.

Various types of dyes and combinations of alizarine and chrome mordants have been tried, but none has been as resistant to the elements and service use as the present adopted standard. The Navy appreciates the difficulties of the manufacturer in the handling of indigo with its properties of staining and penetrating, which practically force the mill man to tie up equipment for government work. However, until the dye manufacturer is successful in producing a dye comparable in all respects with indigo, the Navy will continue to require indigo. If at any time a dye is developed that will meet our requirements, the Navy will certainly consider it. At the present time we are experimenting with piece dyeing, using the various forms of indigo in combination with alizarine and mordants. If any of you care to submit your ideas to us, or experiment with us, we would be most appreciative of your efforts.

The color fastness requirements are that it shall be equal to the standard sample in fastness to light, laundering, crocking, and perspiration. For the fastness to light test, the specimen is exposed for 40 hours to the radiation from a glass-enclosed carbon-arc lamp, such as the Fade-Ometer. For the fastness to laundering test, the specimen is attached to a white cotton cloth and placed in a soap solution in a Launder-Ometer. The amount of bleeding onto the white cloth and the loss of color on the fabric itself determines the dye fastness to laundering. For the fastness to crocking test, two specimens, one dry and one wet, are tested by rubbing against bleached white cotton cloth with a Crock-Meter. For the fastness to perspiration test, two specimens are used each attached to a white cotton-worsted union cloth, one is placed in an acid perspiration bath and the other is placed in an alkaline perspiration bath. The amount of staining on the white union cloth governs the dye fastness to perspiration.

Now let us consider a cotton fabric. Our bleached cotton twill is used in the enlisted man's white uniform, worn continuously in the tropics, and during the summer months in the temperate zone. It is cool, has body, and good draping qualities. It has stood up very well under the not too kind treatment of ship board laundries and the every-day activity of ship's work and drills, and still maintained its good appearance. Specification requirements are that it be made from thoroughly cleaned, well carded and combed, and evenly spun cotton of grade and staple to meet specification requirements. The weave must be a three up and one down twill to the left. Fabric construction shall be not less than 100 ends per inch by 54 picks per inch. Breaking strength by the grab method shall be not less than 170 pounds in the warp and 110 pounds in the filling. No sizing is permitted, an allowance of 3 per cent will be made for natural pectin matter contained in cotton. The fabric shall be fully bleached, but shall not be underbleached or overbleached. The determination of under or overbleaching is made in accordance with the cuprammonium fluidity test, with which you are all more or less familiar. Further shrinkage of the finished fabric must not exceed 1 per cent in length or width.

Some of you may be wondering why the Navy places so much stress on appearance and serviceability. The enlisted man of the Navy is not given a clothing allowance from which to draw articles of uniform. He is given an initial outfit of clothing. From then on he must pay for all replacements. Because the sailor buys his clothing, it is the duty of the Naval Clothing Depot to procure, manufacture, and sell garments of the best possible quality at the most reasonable prices.

As for the justification and maintenance of specification requirements, I should say something about the Textile Inspection Group at the Naval Clothing Depot. It is this activity which is charged with the responsibility of: the maintenance of standard samples, the initiating of experimental work, the drafting of specifications, and the thorough inspection and testing of all fabrics and garments that make up the enlisted man's uniforms.

We have a physical testing laboratory and a chemical testing laboratory. Both are adequately equipped, at the present time, to perform all tests required. All physical and chemical tests are conducted in accordance with Federal Specification CCC-T-191a; Textiles; Test Methods.

Specifications on textiles are drafted, changed, and revised only after extensive tests to determine its suitability. Constant studies are being carried on in the revision of specifications to allow the use of suitable fabrics with a higher rate of production and a broader source of supply.

Some of the items which we are experimenting with at the present time are: The substitution of nylon thread in place of linen thread in the construction of shoes; the substitution of either mercerized cotton or nylon sewing thread in place of silk thread in the manufacture of garments; the development of a suitable rayon neckerchief; the development of a suitable rayon cap ribbon; the de-

(Concluded on page P17)

Intersectional Contest—

☆ *Winner of First Prize*

COTTON FABRIC CONSTRUCTIONS

in Relation to Water Resistance

Presented by P. J. Wood for the New York Section

INTRODUCTION

THE treatment of fabrics to resist the penetration of water without destroying the air porosity necessary for bodily comfort has grown to tremendous proportions during the last decade and particularly in the past three years. A generation ago, water resistant fabrics were used almost exclusively for raincoats. Today, water resistant fabrics are used for active sports clothes, for ski jackets, for golfing, hunting, fishing and sailing outfits. The reversible topcoat and the water resistant cotton jacket have been adopted by the younger generation. Children living in cold weather areas wear resistant snow suits that must keep them warm and dry under the most difficult conditions.

The use of water resistant finishes has been specified by the Q.M.C. for added protection in army field jackets, ski troop parkas, parachute troop uniforms, overcoat linings, and a host of other military needs.

It is estimated that more than 20,000,000 yards of cotton fabrics are treated with water resistant finishes *each month* for civilian and governmental purposes.

Significant advances have been made in the chemistry of water resistant finishes, yet today, fabrics are still selected for resistant finishing with little or no knowledge of the relation between construction and water resistance.

Serious and costly confusion has thus existed in the trade as a result of attempting to produce water resistant finishes on cotton constructions *which had neither been designed nor intended for such use*. Lack of basic information and lack of study of the extremely important factor of proper fabric design for maximum protection and service were leading to the same costly errors which attended the indiscriminate weighting of silk constructions in the past, regardless of whether or not the constructions were specifically planned or suitable for certain exacting requirements.

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Grateful acknowledgment is made for the invaluable cooperation of: Mr. E. J. Driscoll of the Sayles Bleacheries, General W. A. McCain and Col. Painter of the Q.M. Division, for the loan of Army apparel for exhibition; Mr. G. A. Slowinske, Mr. J. R. Bonar, Mr. H. C. Borghetty, Mr. H. Lavery, Mr. P. J. Kennedy, Mr. Pope and especially for the generous cooperation of the executives of mills and converters in supplying the cloth and those loaning civilian garments for display. Through the courtesy of the Better Fabrics Testing Bureau Laboratories all tests were carried out under identical conditions and on the same instruments.

OBJECT

The purpose of this investigation was to provide first-hand data obtained from a study of processing and testing more than 50 constructions under controlled, practical, mill conditions. It was hoped that the mass of data obtained would clarify a problem of vital concern to designers, manufacturers, converters, dyers, finishers, retailers, and consumers and that the data and interpretations would stimulate further study and work in this field.

PROCEDURE

An unselfish and wholly cooperative effort on the part of a large number of individuals and companies made possible the contribution of nearly 2,500 yards of cloth from greige mills and converters. It made possible the mill processing of the cloth and the laborious task of gathering, assembling, studying, and interpreting the data.

Fifty-two different fabrics were selected, covering all of the basic types of constructions used for sportswear, rainwear and military purposes. These constructions varied from coarse lining cloths to heavy poplins and fine twills.

The fabrics, in 40 to 50 yard lengths, were all assembled at one finishing plant and processed under regular commercial conditions. (The plant selected was one which is thoroughly skilled in the application of all types of water resistant treatments.) They were kier boiled, bleached, vat dyed, and then cut three ways. One part was set aside as a check. The other two were treated with two radically different types of water resistant finishes, designated as "A" and "B." The repellent used is unimportant from the viewpoint of construction so long as satisfactory repellency is conferred on the fabric.

The finished fabrics were then studied and analyzed. They were subjected to a total of more than 7,500 tests to check the efficiency of the finishes and the construction of the different cloths. These tests were made by competent technicians who journeyed to a central laboratory to make the supervised tests under similar conditions and on the same instruments.

NOTE: *This paper was presented at the Annual Meeting in Pinehurst, N. C., on October 31st. Papers presented by other Sections were published December 8, 1941.*

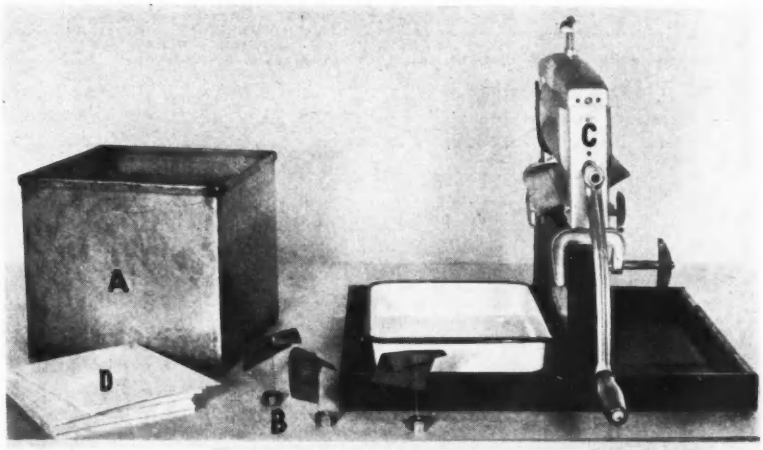


Fig. 1

SUMMARY

Turning to the chart, it will be seen that the fabrics were checked in the greige and after finishing for width, count, weight, and size and ply of yarns in both warp and filling. The treated fabrics were tested according to the following six test procedures:—

1. Immersion test.
2. Spray test.
3. Impact penetration test.
4. Rubbing penetration test.
5. Hydrostatic pressure test.
6. Air permeability test (Gurley).

The spray and immersion tests are primarily used to show the *water resistance of the fibers and yarns, irrespective of fabric construction.* These two tests were conducted according to methods outlined in the 1941 Year Book of the A.A.T.C.C. (Fig. 1, Immersion Test; Fig. 2, Spray Test; Fig. 3, Spray Test Rating Chart.) They were used in this work to establish the effectiveness of the water repellent applications. The impact, rubbing, hydrostatic, and air porosity tests are essentially *penetration* tests and are therefore closely related to *construction.*

The impact penetration test (Fig. 4) is essentially the spray test in all details except that (1) the spray drop is 24 inches instead of 6 inches and (2) a piece of blotting paper or absorbent cloth is inserted beneath the cloth being tested in order to show the amount of water driven *through* the test cloth after the standard 250 cc. of water at 80° F. has sprayed on it from a height of 24 inches. The gradings "No Penetration," "Very Slight Penetration," or "Complete Penetration" were used to describe the results qualitatively. (The 6 inch spray test estimates the wetting of the fabric but does not evaluate the amount of water which penetrates through the interstices of the cloth.)

The rubbing-penetration test (Fig. 5) was developed to measure the water forced through a repellent fabric by mechanical action. It was carried out by clamping a dry,

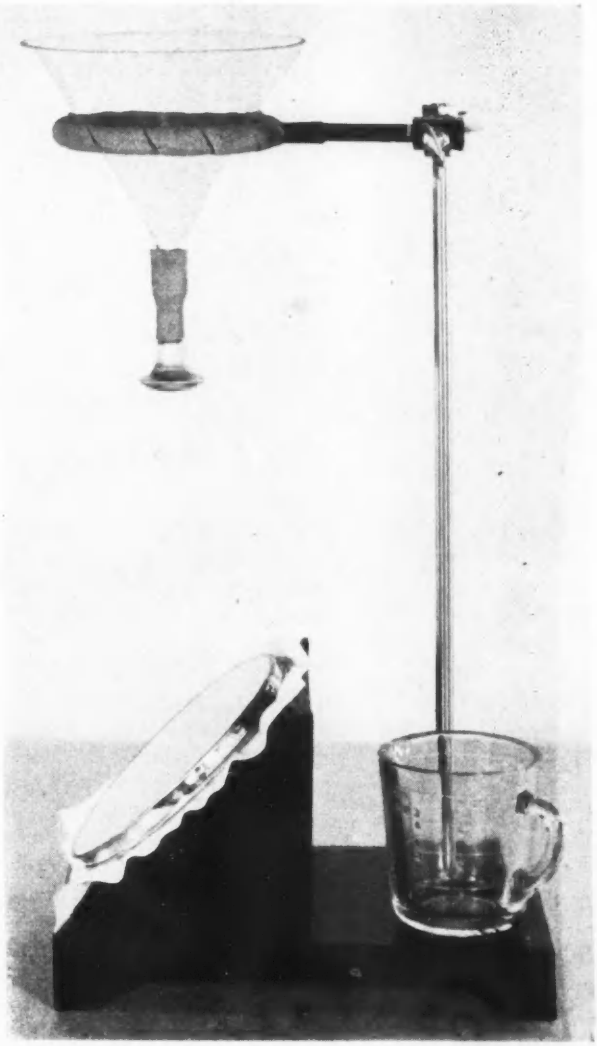


Fig. 2

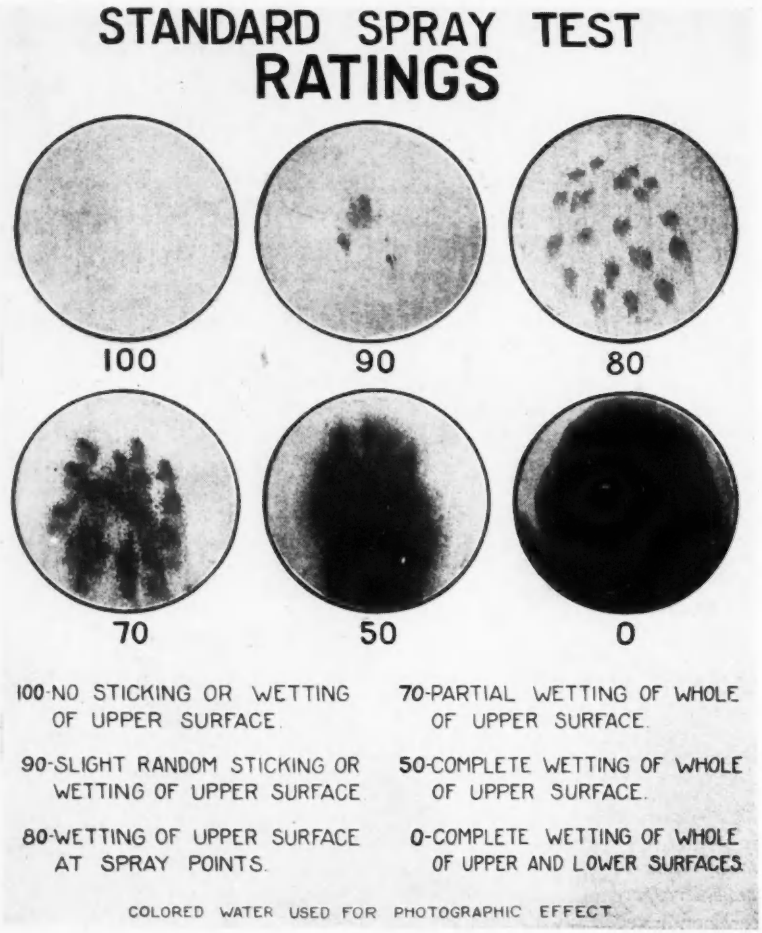

STANDARD SPRAY TEST
RATINGS
100
90
80
70
50
0
100-NO STICKING OR WETTING OF UPPER SURFACE.
90-SLIGHT RANDOM STICKING OR WETTING OF UPPER SURFACE.
80-WETTING OF UPPER SURFACE AT SPRAY POINTS.
70-PARTIAL WETTING OF WHOLE OF UPPER SURFACE.
50-COMPLETE WETTING OF WHOLE OF UPPER SURFACE.
0-COMPLETE WETTING OF WHOLE OF UPPER AND LOWER SURFACES.
COLORED WATER USED FOR PHOTOGRAPHIC EFFECT.

Fig. 3

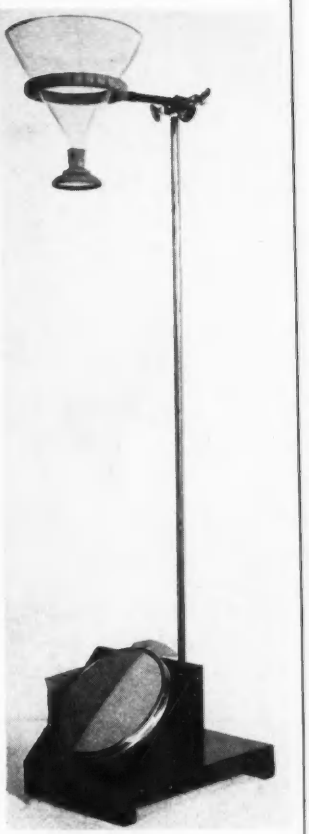
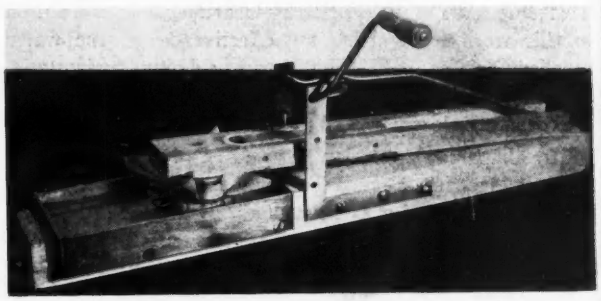


Fig. 4

Below—Fig. 5



weighed sample of absorbent cotton cloth over the lower end of a short cylindrical block of wood attached to a standard A.A.T.C.C. Crockmeter. The cloth to be tested was then clamped over the absorbent material and rubbed 30 complete strokes, under a constant pressure, on the bottom of a pan containing a shallow layer of water. The absorbent liner was then quickly removed and weighed immediately. The per cent moisture absorbed by the liner was calculated and represented the amount of water which penetrated through the fabric being tested.

The hydrostatic pressure tests (Fig. 6) were made according to the standard procedures published in the 1941 A.A.T.C.C. Year Book.

The air porosity tests were made on a new type of apparatus constructed to measure more accurately the air flow through the interstices of cloths (Fig. 7).

A single test method should not be relied on to evaluate properly a fabric or finish but several methods should be used to obtain a clearer interpretation.

The actual test results are shown on the chart (Fig. 8). The fabrics used in the study are available for examination on these two panels (Fig. 9). The test instruments are on display on the platform.

To illustrate the influence of construction on two popular textiles which have been treated with repellent agents in an identical manner, consider the two poplin fabrics, No. 4 and No. 7. These two cloths may be considered of equal weight; each running approximately 2.75 yards per pound by test. The No. 4 fabric has a 46/2 ply warp and 22 singles filling, while the No. 7 cloth has a 31 singles warp and 17 singles filling.

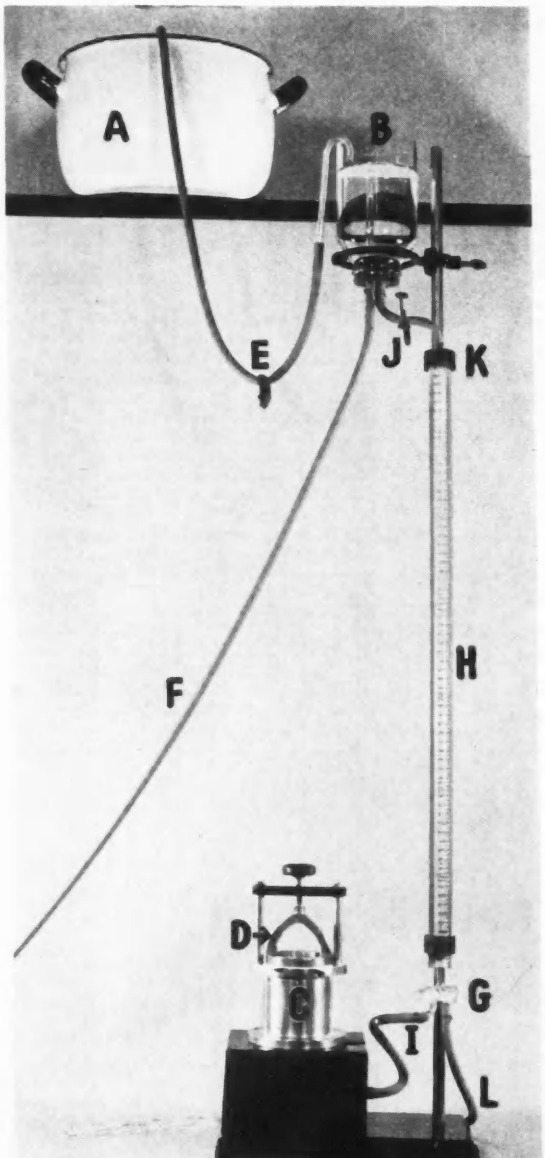


Fig. 6

The number of threads per inch in each cloth is about the same, and the distribution is not dissimilar—that is, the ratio of warp to filling is 1.6 in No. 4 and 2.0 in No. 7. These figures fall within the range of constructional balance.

Note the important point that the variable factor is the size of the yarn. This difference in yarn size is responsible for leakage in No. 7 fabric during the penetration tests, and it is also responsible for the difference in porosity.

The hydrostatic pressure value of poplin No. 4 is 39 centimeters. This is 9 centimeters above the standard suggested as necessary to protect against leakage. On the other hand, poplin No. 7 has a resistance of only 22 centimeters. This is below the normal average for satisfactory repellent clothing.

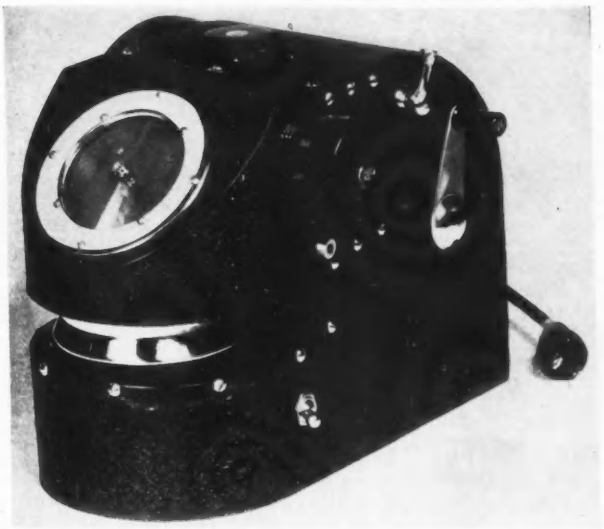


Fig. 7

Doubled fabrics are often used in garments designed for protection against water. Data developed in the course of this study indicate that a double thickness of a fabric, not suitable when used single thickness, will afford protection approaching that given by a single thickness of a more closely woven cloth. Naturally, even for two thicknesses the fabric employed should be fairly closely woven.

Other important facts were found in that the *hydrostatic pressure and the porosity tests may be correlated* so that, knowing one value, the other can be obtained. This may be illustrated by a graph prepared by plotting breathability against the standard A.A.T.C.C. hydrostatic pressure test values. At approximately 35, the hydrostatic pressure and air porosity values are equal.

Hydrostatic pressure values may be correlated also with impact penetration values; thus showing that *air porosity may be used to predetermine the properties of the finished textile even before it is treated for repellency.*

Impact penetration and abrasion penetration tests reveal the same property of a treated textile and represent the nearest approach, under laboratory practice and control, to evaluation of the suitability of various fabrics for severe weather conditions.

The possibility of patent protection for the Association on the results of this research is being studied by the committee.

CONCLUSIONS

This cooperative research has yielded information so significant that a broad advance has been achieved toward placing the whole problem on a sounder and more scientific basis—to the profit of all concerned, from designer to consumer.

COTTON FABRIC CONSTRUCTION

Prepared by New York Section

	FABRIC NUMBER	WEAVE	ACTUAL GREIGE: COUNT Per Sq. In.	WEIGHT Yds. / Lb.	WIDTH Inches	WEIGHT 36" Width	YARN NUMBER: Warp	Filling	YARN PLY	CONSTRUCTIONS: COUNT Per Sq. In.	WEIGHT Yds. / Lb.	WIDTH Inches	FINISHED WIDTH	YARN NUMBER WARP
POPLIN	1	Poplin	100x58	2.40	38	2.54	37	16	2x1	105x54	2.61	36¼	2.5	42
	2	Poplin	102x64	2.28	38⅜	2.44	38	19	2x1	104x60	2.68	37½	2.5	42
	3	Poplin	102x60	1.96	40½	2.20	43	13	2x1	106x56	2.52	38½	2.5	47
	4	Poplin	102x64	2.72	37½	2.83	46	22	2x1	108x61	3.04	35½	3.0	51
	5	Poplin	144x70	2.78	40½	3.13	84	43	2x2	148x64	3.36	38½	3.0	94
	6	Poplin	100x51	3.20	38½	3.42	46	25	2x1	106x47	3.92	38½	3.6	52
	7	Poplin	114x58	2.89	38	3.05	31	17	1x1	121x55	3.57	36	3.3	39
	8	Poplin	108x48	3.60	36½	3.63	56	24	2x1	106x48	3.69	36½	3.7	56
	9	Poplin	104x48	3.65	36	3.65	55	24	2x1	107x48	3.52	36	3.5	57
	10	Poplin	98x44	4.13	38	4.36	27	32	1x1	105x42	5.14	35½	5.0	33
PLAIN CLOTH	11	Plain Cloth	158x140	5.75	37½	6.00	87	84	1x1	170x136	6.22	34½	5.9	85
	12	Plain Cloth	142x154	5.48	40	6.10	71	83	1x1	160x144	6.35	35	6.1	91
BROADCLOTH	13	Broadcloth	144x85	2.39	40 3/4	2.70	71	71	2x3	145x79	2.89	40	3.0	81
	14	Broadcloth	144x78	2.83	37½	2.95	37	26	1x1	146x73	3.17	36	3.0	43
	15	Broadcloth	142x74	3.99	38½	4.24	82	98	2x2	147x71	5.06	37½	4.8	100
	16	Broadcloth	140x80	3.55	37½	3.67	33	48	1x1	149x79	4.42	35 3/4	4.3	42
	17	Broadcloth	142x78	3.76	37 3/4	3.94	35	55	1x1	148x72	4.82	36	4.8	46
	18	Broadcloth	150x76	3.06	41	3.48	47	27	1x1	154x72	3.58	39 3/4	3.6	37
	19	Broadcloth	136x60	3.68	40	4.08	36	40	1x1	140x59	4.60	38½	4.4	45
	20	Broadcloth	136x64	3.99	37½	4.15	31	43	1x1	142x59	5.15	35½	4.8	42
	21	Broadcloth	112x60	3.50	37½	3.64	27	31	1x1	118x57	4.45	35	4.1	34
	22	Broadcloth	99x60	4.20	37½	4.36	27	42	1x1	106x57	5.34	34½	5.0	34
PRINT CLOTH	23	Print Cloth	80x80	4.25	39½	4.66	28	44	1x1	91x73	5.20	34	4.8	34
	24	Print Cloth	80x62	5.06	37	5.23	25	46	1x1	88x58	6.34	32½	5.7	33
	25	Print Cloth	64x60	5.39	38½	5.72	28	40	1x1	70x56	6.85	34½	6.4	34
GABARDINE	26	Gabardine	124x72	1.72	39½	1.89	28	25	2x1	181x72	1.84	37	1.9	32
	27	Gabardine	128x74	1.89	39 3/4	2.09	31	31	2x1	134x71	2.25	37	2.1	33
	28	Gabardine	110x78	1.85	39½	2.03	16	20	1x1	120x74	2.24	36½	2.2	19
	29	Gaberdine	109x76	2.09	39½	2.29	15	26	1x1	117x70	2.37	36½	2.3	20
HERRINGBONE	30	Herringbone Twill	92x52	1.52	40	1.69	16	7	1x1	98x48	2.00	37	2.0	19
	31	Herringbone Twill	66x48	1.58	40	1.76	9	9	1x1	71x44	1.97	36½	1.9	11
TWILL	32	Twill	179x103	2.52	38½	2.68	72	77	2x2	191x98	3.07	36	3.0	67
	33	Twill	104x56	1.72	40½	1.92	33	25	2x2	109x55	1.99	37½	2.0	38
	34	Twill	104x56	1.56	43 3/4	1.90	15	12	1x1	111x52	1.96	40½	2.0	18
	35	Twill	88x56	1.73	41½	1.98	26	12	2x1	89x53	2.07	39½	2.0	31
	36	Twill	124x62	2.04	40½	2.29	36	22	2x1	128x60	2.32	39	2.3	40
	37	Twill	98x54	2.14	31½	1.87	14	11	1x1	103x50	2.75	29½	2.5	16
	38	Twill	114x70	2.37	39½	2.59	20	22	1x1	118x64	2.94	37½	2.8	23
	39	Twill	86x43	1.82	37½	1.90	13	8	1x1	92x41	2.26	34½	2.5	15
	40	Twill	88x44	2.07	37	2.13	14	9	1x1	93x41	2.51	34½	2.9	18
	41	Twill	96x64	2.89	38½	3.07	21	23	1x1	103x61	3.82	34 3/4	3.9	27
	42	Twill	102x60	4.30	37	4.41	28	38	1x1	114x58	5.04	32½	4.8	34
WARP SATEEN	43	Warp Sateen	120x60	2.38	38	2.51	22	18	1x1	125x59	2.85	35½	2.8	28
	44	Warp Sateen	116x60	2.43	38½	2.60	21	17	1x1	125x60	2.80	35½	2.8	27
	45	Warp Sateen	104x56	2.81	38 3/4	3.02	20	22	1x1	113x56	3.44	35½	3.9	25
FLANNEL	46	Flannel	49x41	3.51	33½	3.26	26	11	1x1	52x42	3.32	34	3.5	25
	47	Flannel	50x40	3.46	33	3.17	25	11	1x1	49x43	2.94	33 3/4	2.8	26
SHEETING	48	Sheeting	64x68	3.10	40½	3.46	19	24	1x1	74x64	4.07	35	3.6	23
	49	Sheeting	48x48	2.90	40½	3.25	16	14	1x1	58x46	3.94	34	3.2	20
	50	Sheeting	56x60	3.78	40½	4.25	18	25	1x1	65x58	4.63	34 3/4	4.6	25
	51	Sheeting	34x28	2.97	36	2.97	8	7	1x1	38x27	3.64	31½	3.7	10
	52	Sheeting	32x28	3.73	40½	4.18	11	11	1x1	35x26	4.42	36	4.2	14

GROUP A - Durable Finish
GROUP B - Non-Durable Finish
GROUP C - Untreated Fabric

Fig. 8

A future course has been pointed out which should correlate fabric construction with effective water resistance and protection.

A method for experimentally *predicting* the suitability of construction has been found. *The protection which may be expected from a fabric after proper water resistant finishing may be accurately foretold in less than* 30 *seconds by means of an air porosity test on the untreated fabric.*

Two new testing instruments were constructed for this work; namely, the impact penetration tester and the rubbing-penetration tester. The first use of a new air porosity tester was made on textiles to evaluate the influence of construction on water resistance.

It has been shown that desirable fabrics should consist

STRUCTION IN RELATION TO WATER RESISTANCE

ion - A.A.T.C.C. - September 26, 1941

		YARN NUMBERS WARP	YARN NUMBERS FILLING	YARN PLY	THREAD PER SQ. IN.	AVERAGE COUNT	REPELLENCY RATINGS: INVERSION % ABSORBED Group A	INVERSION % ABSORBED Group B	SPRAY TEST Group A	SPRAY TEST Group B	PENETRATION RATING IMPACT Group A	PENETRATION RATING IMPACT Group B	PENETRATION RATING ABRASION Group A	PENETRATION RATING ABRASION Group B	HYDROSTATIC RESISTANCE CM. OF WATER Group A	HYDROSTATIC RESISTANCE CM. OF WATER Group B	AIR POROSITY PERMEAMETER READING Group A	AIR POROSITY PERMEAMETER READING Group B	AIR POROSITY PERMEAMETER READING Group C	FABRIC NUMBER
	2.3	42	18	2x1	159	18	10	20	100	70	NP	NP	NP	VSP	51	42	22	23	24	1
	2.9	42	21	2x1	164	19	10	18	100	80	NP	NP	NP	NP	43	35	26	26	31	2
	2.9	47	15	2x1	162	18	13	24	100	90	VSP	VSP	NP	SP	42	30	31	39	34	3
	3.0	51	25	2x1	169	21	11	18	100	80	NP	VSP	VSP	SP	39	32	30	32	30	4
	3.7	94	45	2x2	212	32	7	19	100	80	VSP	VSP	NP	SP	41	32	33	37	37	5
	3.8	52	26	2x1	153	25	12	20	100	90	CP	CP	CP	CP	24	19	62	63	66	6
	3.8	39	18	1x1	176	27	5	19	100	80	CP	CP	CP	CP	22	20	83	94	96	7
	3.7	58	24	2x1	154	24	16	45	100	90	CP	CP	CP	CP	24	17	81	73	68	8
	3.8	57	24	2x1	155	23	15	47	100	50	CP	CP	CP	CP	22	16	87	76	70	9
	5.0	33	31	1x1	147	31	13	16	100	80	CP	CP	CP	CP	13	11	399	332	341	10
	5.8	85	84	1x1	306	78	11	16	100	80	CP	CP	SP	CP	45	38	60	52	54	11
	6.3	91	81	1x1	304	80	7	15	100	90	CP	VSP	SP	CP	45	45	55	44	55	12
	3.0	81	77	2x3	224	30	12	15	100	90	NP	NP	NP	NP	51	50	27	31	30	13
	3.7	43	27	1x1	219	29	10	18	100	100	CP	CP	SP	CP	38	34	39	48	43	14
	5.0	100	117	2x2	218	48	10	13	100	80	CP	CP	CP	CP	39	32	57	59	62	15
1/4	4.3	42	51	1x1	228	42	8	16	80	80	CP	CP	CP	CP	32	32	56	60	57	16
	4.8	46	53	1x1	220	45	5	20	100	90	CP	CP	SP	SP	33	30	70	70	74	17
1/4	3.9	57	29	1x1	226	38	10	15	100	50	CP	CP	CP	CP	20	20	91	85	69	18
	4.1	45	37	1x1	199	42	14	23	100	90	CP	CP	CP	CP	22	26	123	111	132	19
	3.9	42	82	1x1	201	43	10	17	100	90	CP	CP	CP	CP	22	21	131	108	96	20
	4.3	34	34	1x1	175	32	13	18	100	90	CP	CP	CP	CP	20	21	132	126	123	21
	5.0	34	42	1x1	183	35	9	20	100	80	CP	CP	CP	CP	18	19	269	212	204	22
	4.9	34	44	1x1	164	34	10	18	100	90	CP	CP	CP	CP	16	17	335	266	241	23
	5.7	35	53	1x1	146	35	11	16	100	80	CP	CP	CP	CP	13	13	542	644	533	24
	4.6	34	41	1x1	126	35	12	21	100	50	CP	CP	CP	CP	10	10	841	796	733	25
	1.9	32	25	2x1	203	16	13	23	80	80	CP	CP	CP	CP	26	24	53	52	58	26
	2.1	33	31	2x1	205	20	15	19	100	80	CP	CP	CP	SP	31	26	51	47	56	27
	2.2	19	20	1x1	194	18	13	19	100	80	VSP	VSP	NP	NP	32	27	62	51	52	28
	2.3	20	28	1x1	187	19	13	20	100	100	CP	CP	CP	CP	26	20	66	86	93	29
	2.3	19	12	1x1	146	12	9	18	90	80	NP	SP	NP	NP	28	27	38	44	41	30
	1.9	11	10	1x1	115	10	12	20	100	100	CP	SP	SP	SP	27	22	47	53	55	31
	3.7	87	77	2x2	289	38	13	18	100	100	NP	NP	NP	NP	67	57	22	19	25	32
	2.7	38	24	2x2	164	14	12	17	100	100	NP	SP	NP	NP	35	34	34	33	37	33
	2.9	18	12	1x1	163	15	10	17	100	70	VSP	VSP	NP	NP	36	34	35	43	39	34
	2.3	31	12	2x1	142	13	11	23	100	90	SP	SP	NP	NP	31	25	50	49	56	35
	2.8	40	24	2x1	188	20	10	24	100	80	CP	CP	CP	CP	33	28	51	49	57	36
	2.5	16	13	1x1	153	14	12	17	80	80	CP	CP	CP	CP	26	25	74	66	49	37
	3.4	23	25	1x1	182	23	15	19	100	100	VSP	VSP	NP	SP	37	34	44	49	56	38
	2.5	15	8	1x1	133	12	13	17	90	80	CP	CP	CP	CP	22	22	93	78	82	39
	2.9	18	9	1x1	134	13	12	20	100	90	CP	CP	CP	CP	19	20	154	118	112	40
1/4	3.9	27	29	1x1	164	25	11	15	100	90	CP	CP	CP	CP	21	19	118	95	116	41
	4.3	34	39	1x1	172	33	5	18	100	80	CP	CP	CP	CP	17	15	300	352	236	42
	2.8	28	18	1x1	184	22	15	21	90	100	CP	CP	SP	CP	32	27	68	64	78	43
	2.6	27	19	1x1	185	22	11	13	100	100	CP	CP	SP	CP	24	22	95	85	102	44
	3.9	25	24	1x1	169	24	13	17	90	90	CP	CP	CP	CP	22	20	132	118	165	45
	3.3	25	10	1x1	94	12	12	16	100	80	SP	CP	NP	SP	24	25	142	124	129	46
3/4	2.6	26	10	1x1	92	11	11	17	100	70	CP	CP	CP	CP	25	23	161	141	123	47
	3.6	23	24	1x1	138	23	13	19	80	80	CP	CP	CP	CP	18	18	161	132	170	48
	3.2	20	17	1x1	104	16	10	17	100	80	CP	CP	CP	CP	12	13	293	268	294	49
1/4	4.6	25	26	1x1	123	23	8	18	100	80	CP	CP	CP	CP	13	14	308	277	323	50
	3.7	10	12	1x1	65	9	13	17	80	80	CP	CP	CP	CP	7	6	714	801	599	51
	4.2	14	10	1x1	62	11	9	18	100	80	CP	CP	CP	CP	6	6	1082	955	868	52

NP = No Penetration
VSP = Very Slight Pen.
SP = Slight Pen.
CP = Complete Pen.

0 = No Porosity
1600 = 100% Porosity

Fig. 8

of a judicious combination of proper construction, suitable permeability to air and satisfactory water resistance of fibers and yarns.

These extensive researches contribute to the various groups making up the A.A.T.C.C. membership as follows:—

1. *To those who design textiles, lay out cloth patterns, and weave greige fabrics,* this research offers a means of predetermining the essentials of yarn and weave characteristics to obtain suitable repellent fabrics for outdoor wear. Thus by preliminary selection of proper yarns, type of weave, and without change of facial characteristics, a fabric may be constructed on which the repellency effects may be foretold *before the fabric is actually woven.*

Fig. 9

2. *To chemists concerned with formulation, processing and testing,* this research presents a new means of evaluating water repellent effects in relation to various cloth constructions.

3. *To textile finishers, converters, and garment manufacturers,* this research provides a new means of predicting and evaluating the overall value of repellent fabrics, thus aiding in supplying garments of balanced character to give superior service in outdoor wear.

4. *To the consuming public,* this research makes possible the assurance of repellent garments which are attractive, comfortable, and of real protective utility, because they have been scientifically designed on the basis of predetermined facts.

5. *To the armed forces of our nation,* "cotton fabric construction in relation to water resistance" was a research study planned to devise methods of evaluating clothing fabrics now in use and to aid in the future selection of protective clothing for the services.

The results of this study will be of real assistance in maintaining the high standard of protection in the clothing chosen for the defenders of our country, even if future conditions necessitate changing to new materials. To this extent, this research will help to maintain, in dry comfort, the boys in service in Arctic waste or humid jungle, wherever they may be on land or sea.

MEETING, LOWELL TEXTILE INSTITUTE STUDENT SECTION

THE second meeting of the season of the Lowell Textile Institute Student Chapter was held December 3, 1941. Chairman Ernest James introduced Mr. William G. Chace, a member of the Institute's faculty, who gave a lecture on enzymes and their use in the textile industry.

Respectfully submitted,

STANLEY SZOPA, *Secretary.*

LIGHT FADING CLINIC

Saturday Afternoon, November 1, 1941

THE Light Fading Clinic convened in the Grand Ballroom, The Carolina, Pinehurst, North Carolina, at 12:15 o'clock, Carl Z. Draves, President, presiding.

President Draves: The subject of Light Fading has always been important to the dyer and the textile chemist and especially lately modifications of equipment for accelerated light fading have come on the market. This morning we are going to have a discussion of this subject.

. . . The papers were then presented . . .

Light Fading Clinic—

Fundamental Concepts in

FADE-OMETER DESIGN and OPERATION

E. H. HARVEY, Ph.D.
Atlas Electric Devices Co., Inc.

INSTRUMENTATION has played a conspicuous part in research and in the industrial application of the laboratory sciences to business and better living. A number of members of this audience are to be thanked for their individual efforts, and collectively the Association as a whole, for the part played in such a movement, for within less than a quarter century the Fade-Ometer has grown from a nebulous idea to an instrument of hefty size, having become the international yardstick for measuring color fastness.

Of its commercial success and consumer confidence you are most adequately aware. The billions of yards and the millions of dollars represented by the samples successfully scrutinized before entering the channels of trade, testify to that. But point is made of this in passing lest we lose perspective in the discussion to come and fall into the too human error of magnifying differences, rather than emphasizing similarities. This does not in any sense imply a sacrosanct attitude. Nothing is good enough if better can be imagined. But the Fade-Ometer long since quit private life to become a public official and your writer does not believe its status should be altered except by majority vote of an organized group representing the industry it serves.

The overemphasis of simplicity in use, which has led to a disregard of the care necessary to secure quantitative results, plus lack of understanding of concepts fundamental to color-fast testing, prompts a brief review of work in this field.

THEORIES OF FADING

In 1817 Grotthus[1] postulated that only those rays which are absorbed are capable of producing chemical action. Applying the theory to dyes, Silbermann[2] stated the destruction of a color might be due either to oxidation or reduction. Of the two theories, the former has received the greater support. From results on the influence of the atmosphere on color loss, it has been observed that oxygen of the air is usually required if fading is to take place. Such an oxidizing action can be explained as resulting from either the direct action and oxygen under the influence of light, resulting in the production of a colorless body, or by peroxides formed from the ultraviolet decomposition of moisture in the fabric. Unfortunately for the latter theory, no one has experimentally demonstrated the presence of peroxides, nor is it believed possible to produce such compounds with any wave length found in actual sunlight.

Since some dyed fabrics fade in a vacuum, reduction has been suggested, the theory being that sunlight reduces directly, or is responsible for the fabric reducing the color. Harrison[3] attempted to reconcile these conflicting viewpoints, concluding:

"There are four things to be considered in problems of fading. The nature of the light, the coloring matter, the fiber and the atmosphere. Under the influence of light many possible reactions may occur:

1. The light may convert oxygen into ozone and this, or the oxygen itself, may oxidize the dyestuff;
2. The fiber may reduce the dyestuff;
3. Both 1 and 2 may occur at the same time;
4. The air or ozone may oxidize the fiber and produce substances more capable of reducing the dyestuff;
5. The air or ozone may oxidize the dyestuff and produce a substance more easily reduced by the fiber or its oxidation products;
6. The fiber may reduce the dyestuff or otherwise react with it to produce substances more easily oxidized by the air;
7. The light may cause one portion of the color molecule to react with another.

When other substances are present on the fiber or in the atmosphere, their effect on all the above reactions must be considered. The large number of possible reactions shows how complex a problem it is to ascertain the cause of the fading of dyestuffs. The results obtained up to the present seem to show that none of the theories proposed is incorrect, but that each theory applies to a limited number of dyestuffs only, whereas it has been the general procedure of authors to apply their theories indiscriminately to all dyestuffs."

Cunliffe[4] remarks that Harrison's results appear to indicate that direct colors fade by reduction, basic colors by oxidation, and that the reducing power of cellulose increases with the intensity of the arc radiation.

Other theories advanced to explain the mechanism of fading vary from enzymes and intramolecular changes, to photochemical rearrangements and constitution.

FACTORS OTHER THAN THE DYE CONTRIBUTING TO FASTNESS

(a) Effect of dye concentration

The impression prevails generally that deep shades are faster than the pastels. Work of Barker, Hirst and Lambert[5] shows that loss of color was independent of the depth of shade. If the total color loss is the same for all shades, then it is a much higher percentage of the total color in the light than in the deep shades. Since then

Pinte[6] advanced the idea that dyes exhibit a maximum sensitivity to light when present on fibers at a certain concentration called the "mean critical tone," and fastness will therefore improve, the further it is from this value.

(b) Effect of fiber.

A given dye is not necessarily equally fast on different fibers.

(c) Method of dyeing.

Fastness is affected by the method of dyeing, mordants having a profound effect.

(d) Finishing materials.

The nature of the finishing agents used for treating most fabrics may influence fastness.

(e) Non-predictability of dyes.

Kischel[7] pointed out many years ago that some dyes fade rapidly at the start, then slow down; others act just the reverse. Some colors turn darker upon exposure. These observations are of great significance, for if fading is not a function of time, other things being equal, then proposed short cuts to standard methods are bound to be seriously in error.

(f) Dye combinations.

Gebhard[8] made the exceedingly important observation that when Anthar Yellow GC is combined in one dyeing with Indanthrene Blue GCD, the Yellow becomes as fast as the Blue, while alone it is much less fast. Many other instances are known where the property of the final product is not the arithmetical sum of the components.

(g) Temperature.

In addition to having an effect on the moisture content of the air, heat has an effect of its own. Goodings[9] reports that he got 75 per cent more fading at 50° C. (122° F.) than at 10° C. (50° F.), moisture being the same. The author has made many comparisons over the years between 105° F. and 145° F., the range generally considered ample to include from wearing apparel to automobile upholstery fabrics. With all conditions identical except temperature, fading tends to increase as temperatures rise. Unfortunately no mathematical expression of the relationship is possible since dyes vary widely in their temperature-fading characteristics.

It should not be overlooked that the temperature of the air surrounding the sample is not the same as the temperature of the sample itself. Dark colored samples absorb substantial quantities of heat and become appreciably hotter than the air.

(h) Relative Humidity.

Due to lack of sunshine in England the British Research Association for Woolen and Worsted Industries set up additional light exposure stations in India, South Africa and Ceylon. Barker and Hirst[10] reported that due to the greater humidity in England, there was more fading than in the tropics; that the fading in the tropics was almost proportional to the relative humidity, hours of sunshine being the same. The curve relating fading loss of color to humidity closely followed that for absorption of water in wool fibers. It reached a saturation point at about 75 per cent relative humidity, after which additional moisture had little effect.

Goodings[9] found that fading which took place at 90 per cent relative humidity was as great as that produced by three times the length of exposure at 30 per cent relative humidity.

More recently Appel[11] studied the rate of fading as affected by relative humidity. He found some dyeings not affected by a change in the surrounding atmosphere ranging from 31 per cent to 75 per cent, while others were.

The author's commercial and research work agrees substantially with the findings of Appel. While in general, relative humidity increases make for greater and more rapid fading, no general rule could be found to express the relationship quantitatively since the resistance of the dyes varies from one to another.

(i) Light sources.

It has been the history of every technical development that real progress is not made until the early qualitative stage is superseded by the quantitative. Claims for sunfastness that were predicated upon direct exposure were unsatisfactory because of variability with place, season, time of day and local climatic condition, not to mention unavailability twenty-four hours a day. The greatest single contribution to the advancement of dye testing, and simultaneously to honest merchandising was the standardization of test conditions. Of these, a light source comparable to the sun is admittedly the most important.

Historically and logically, all attempts at standardizing tests for light fastness began with a study of the sun and surrounding atmospheric conditions. However, the almost overemphasis of the significance of the sun by ignoring other factors involved in fading, and inability to express precisely this "light energy at the sample-environmental condition" relationship, as a common denominator for all geographical locations, has caused much confusion.

Brownlie[12] suggested the photochemical decomposition of potassium iodide in sulfuric acid as a means of measuring the fading action of the sun. The trouble with this and similar approaches is that it oversimplifies the problem by ignoring other environmental factors of importance. Appel[13] tried the suggestion by Bancroft[14] of using a photoelectric cell to correlate sunlight and fading with very disappointing results.

The method in greatest vogue makes use of a standard dyeing whose fastness has been determined by experience, and which is exposed besides the unknown sample under identical conditions to a given endpoint. The fastness of the unknown is then determined by comparing the degree of fading with the standard. International agreement on what standard dyeings to adopt has by no means been settled, but here in America the wool dyeings of our own Association have been very helpful.

Among the first artificial sources of light to be employed was the mercury vapor lamp. Walther[15], Scheurer[16],

Harrison[8], Sisley[17], and Setlik[18] amply proved that the results of such monochromatic light were not at all comparable with those obtained by sunlight. Combinations of mercury vapor and carbon arc lamps advocated by Gebhard[19] proved unsatisfactory, as was the daylight lamp recommended by Busby[20]. The Nernst Lamp was used by Lazareff[21] in 1907 and dropped.

Appel[22] investigated the incandescent lamp as a light source for fading tests, finding it too yellow without a filter, and too slow with one.

Gebhard[23] was one of the early, if not the first, advocates of the carbon arc. Later improvements in carbon manufacture made a testing unit seem feasible to Jameson, who introduced the first successful machine in 1918.

CONCEPTS BEHIND FADE-OMETER DESIGN

The search for light-fast colors is undoubtedly as old as the use of dyes, and goes on apace. The advent of research in the dye and collateral industries has contributed mightily, particularly since World War I when America, suddenly cut off from German importations, was faced with the necessity of establishing chemical independence.

Almost coincident with this development, and in your author's opinion of great importance in expediting the almost universal insistence of protected quality, was the growing public demand for the abolition of *caveat emptor* as the basis of doing business. Passage of the first Food and Drug Law in 1906 marks the beginning of a new epoch, the end of which is not yet in sight, for forward looking merchants and social-minded legislators have carried the idea into many other fields, including textiles.

Into a field full of chaos, for which a very real need existed but no industry agreement on details had been reached, Jameson introduced his first Fade-Ometer in 1919. In common with all pioneering, mistakes were made, largely errors of omission since corrected as refinements became evident. In retrospect, the original machine, like the Model T Ford, suffered from oversimplification; too much emphasis on ultraviolet, and not enough recognition that what was needed was a device for testing a *dye system*, not a dye alone. But crude as it was, it found acceptance for it served as a rough sorting tool and its deficiencies did not blind those using it to the fact that a continuous spectrum, of a quality and quantity approximating sunlight, was fundamentally sound.

It was obvious no color-fast test could be devised which would duplicate natural conditions, for the question immediately arose,—what natural conditions? Any method as variable as the weather it was intended to simulate would be no standard at all.

One approach to the problem was an analysis of local weather bureau data with a view to establishing a standard based on maxima, or an average, plus the usual engineering factor of safety. For instance, it was known that total daylight on a clear day in midsummer in the temperate zones at noon reached an intensity of about 10,000 foot candles on a surface perpendicular to the sun's rays. On a similar day in winter this figure dropped to about 7,000 foot candles. The average intensity for the sixteen hours between sunrise and sunset was 5,500 foot candles.

Luckiesh and Taylor[24] made the interesting statement that skylight had more than twice the effect of sunlight based on their observation that 450 foot candles of skylight for 40 hours had the same fading effect as 3,900 foot candles of sunlight plus skylight for 11 hours. Any light source to approach sunlight plus skylight would have to approximate black body radiation at 6,000° K.

As previous research by others had demonstrated the superiority of the carbon arc lamp over other sources of light, it was a natural step for Jameson, who was already one of the leading manufacturers of carbon arcs to enter the field of accelerated fading.

After much preliminary work with all of the open and enclosed types of arcs none then in use seemed to completely fill the bill. First, the open arc in all of its various forms was discarded because it was not efficient from the point of carbon consumption, it required much attention and, unless special filters were provided, did not give the proper light both from the standpoint of intensity and spectral distribution.

Jameson found that with simple modification one of his enclosed arcs more closely met the general requirements of the industry and yet afforded an economical, trouble free source of light. It could also be used with equal success on either D.C. or A.C. So well designed was the original Fade-Ometer lamp that to this day only minor changes have been necessary or desirable.

In the original model too much emphasis was placed on the fading caused by light only. Control of temperature, addition of humidity, line voltage regulators, etc., were added in subsequent models as rapidly as technological advances made closer control necessary, and as leaders in the industry voiced their needs. True, occasional cries of "gadgetry" were heard. The common human error of not recognizing or controlling variables is not confined exclusively to the lay public.

Perhaps it would not be amiss at this point to remind you that the manufacture of scientific instruments is a peculiarly unique business. Never faced with enough potential business to justify even semi-mass production methods, prices are always higher than some feel justified. Changes in design must be made at frequent enough intervals to reflect advances in the art, if not to satisfy the advanced thinking of the pace-makers, yet avoid upsetting more or less established standards and the charge of creating new business by making old models obsolete. It must not be forgotten that in the last analysis an instrument used by technical men must provide an answer, not pose a problem.

The Fade-Ometer was not designed to be a precision instrument. Assuming one could be built, the price would be outlandishly excessive. Furthermore, one cannot sufficiently reduce the innumerable natural variables to justify the effort. Its world-wide use testifies to its usefulness

but does not at all argue for its infallibility. Like all machines, it is not fully automatic, nor will it supply deficiencies of head and hand. Globes must be washed daily, if the great economical advantages of an enclosed arc are to be retained.

Fairly constant line voltages must be maintained. What more impressive thing can be said than to recall to your mind that the radiation from a carbon arc is directly proportional to the square of the current.

When Jameson[25] introduced Model FDA eight years ago, he described the instrument and the reasons for including the refinements incorporated in it. In the meanwhile, pressure has increased for a model which would provide more uniform light distribution and greater speed. Both requests grow out of a change in textile merchandising.

Twenty years ago dyed textiles were broadly divided into "fast" and "not fast," depending upon whether they met the standards then in vogue. This rigid classification threw into the "not fast" class many textiles of widely varying degrees of fastness, so an intermediate group designated as "commercially fast" was created. Recognizing the problem but not being satisfied with such a non-specific designation in the light of increasing legal responsibility, forward-looking manufacturers and merchandisers developed commercial standards based on Fade-Ometer exposures less than 24 hours, and tagged merchandise accordingly. Obviously shorter exposures magnified the importance of efficient Fade-Ometer operation. Inattention to details that made for slight differences in results between two or more machines in the same laboratory, or between buyer and seller, of minor importance in a 24-hour test, suddenly became very significant in tests of a few hours' duration because the inequalities could not be absorbed over the shorter period. Simultaneously the need for greater speed was stressed to prevent the laboratory from becoming the bottle neck to plant production.

Both these demands have been acceded to in Model FDA-R, together with minor improvements. However, the object of this paper is not to catalog details which can best be secured from company literature, but to briefly review the complex chemistry and physics involved in color testing, and to acquaint you with the steps taken to properly control each variable. How intricate any future model will become depends entirely on your recommendations, for the manufacturer expects to reflect in subsequent models, as he has in the past, the collective viewpoint of his public. And finally, to point out that while the Fade-Ometer has been the standard, due to your support, long before reaching its majority, it is not omniscient; it will not operate without attention, it is not a substitute for technical training and skill, it will not supply a deficiency of good judgment.

Pioneering an idea when it had no official or widespread backing, and living to see its almost universal use as a research tool, an insurance against complaints, and an arbiter in the commerce of nations, is no mean accomplishment for any man.

Let me in conclusion, make this suggestion; that, in the interest of industry, this Association through its committees formulate and incorporate in future standards fastness to light operating technique, and consider giving the Fade-Ometer full official Association recognition, thus avoiding a multiplicity of standards and assuring continuity of sponsorship, but above all else to provide authority for an instrument that has become a legal standard for all practical purposes.

I personally want to thank all committee members individually and the Association as a whole for the splendid assistance received in the past, and you may be assured all our efforts are at your disposal for a full 100 per cent cooperation in the future.

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Textiles for the Army—

(Continued from page P3)

of you that have anything to do with the finishing of woolens and worsteds is, the importance of absolute and positive chemical control throughout finishing processes—don't let a careless finisher ruin the good work your dyer has done.

Last year, while sipping a Coca-Cola with some of your members, I discussed the availability of vat dyes and there seemed to be some question as to whether the industry could keep up with our demands. I later caused an investigation to be made and found that there was no

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shortage at that time but I also found that the capacity was very much limited. Some of the dye manufacturers got busy and increased their capacity but, unfortunately, we also increased our demands for olive drab vat-dyed fabrics to such an extent that today there is either a real shortage of vat dyes of the colors required to dye olive drab fabrics or these finishers that are calling me every other day pleading for help are wasting a lot of money on useless telephone calls.

From the best information that I can obtain, the production of the few colors required for olive drab is running neck and neck with requirements and unless something is done quickly, my money goes on requirements to win by much more than a nose.

The OPM have held certain meetings with representatives of the dye manufacturers and it is expected that definite steps will be taken within the near future to overcome the present shortage. In the meantime, my advice to all of you is, that if you cannot obtain dyes from your regular source, try some of the other manufacturers and when you have tried them all without success, contact the OPM, either through my office or direct, and we will see what we can do for you.

In connection with this apparent shortage of dyestuffs, I want to impress upon you all that National Defense requirements must come first and it may become necessary to reduce the commercial use of some of these dyes in order to meet our needs. Another point I want to stress as strongly as I can is, that if we are to successfully win this war, we must have your utmost cooperation and when it becomes necessary to call you into conference to discuss possible shortages let's all lay our cards on the table and play them face up. This way it will take much less time to solve our problems and get back on an even keel.

I assume that most of you are interested in priorities and how to obtain them. This is something that I am not any too familiar with; therefore, I am not going to try to discuss the question. I will say this though, Lieut. Buck of the United States Navy, who is to follow me on this program should be much more competent to discuss this problem than I am. I say this for the reason that I recently observed that the Navy is assigning the same priority to a pair of drawers for a sailor as they do to a battleship; whereas, the priorities available to the Army are so low as to indicate that there is not much concern as to whether or not the soldier ever gets a pair of drawers.

In a talk of this kind it is very difficult to cover more than a very small fraction of the subject, therefore, I would like to issue an invitation to those of you who have problems in connection with National Defense purchases to see me after this meeting and I will either give you my best answer or tell you where you can get a better one.

Textiles from the Navy Standpoint—

(Concluded from page P5)

velopment of a suitable rayon tie fabric; and of course the eventual use of substitutes for all silk items.

Inasmuch as we have but very meager funds available for experimental purposes, we must depend to a large extent upon the generosity of the manufacturers and suppliers to do most of our experimental work. In this we work together until we get the best solution to our problems, which includes a broad field of supply under competitive bidding.

We feel indebted to this association and to some of its members particularly for their wholehearted cooperation in the solution to some of our problems. In return you have the feeling of knowing that you have contributed something to the defenders of our country.

—— ♦ ♦ ——

ONE HUNDRED AND THIRTY-FIFTH COUNCIL MEETING

THE Council held its 135th meeting in the Carolina Hotel, Pinehurst, N. C., on Friday morning, October 31, 1941. Present were President Carl Z. Draves, presiding; Roland E. Derby and Thomas R. Smith, Vice-Presidents; William R. Moorhouse, Treasurer; Louis A. Olney, Chairman of the Research Committee; Elvin H. Killheffer, P. J. Wood, Robert E. Rose and Alban Eavenson, Past Presidents; Clarence L. Nutting, representing Northern New England; Arthur E. Hirst and Ben Verity, representing Rhode Island; George L. Baxter and Harold W. Stiegler, representing New York; William Ebersold and Charles A. Seibert, representing Philadelphia; Robert W. Philip, representing Southeast; and Harold C. Chapin, Secretary.

The Secretary's report of the 134th Council meeting and financial report of October 23, and the Treasurer's report of October 28, were accepted. The Rhode Island Section asked leave to withdraw its invitation for the 1942 General Meeting because of inadequate hotel facilities, and the Philadelphia Section extended an invitation for the meeting. The matter was discussed but no action was taken. To the present Finance Committee, consisting of E. H. Killheffer, A. P. Howes, W. R. Moorhouse, and P. J. Wood, was assigned by the President the duty of conferring with local Sections on membership, as voted in the 134th Council meeting, with the understanding that this be chiefly with reference to Corporate memberships. A report from L. A. Olney for the Year Book Committee was accepted; and thanks were voted to the Committee and others who helped in preparation of the 1941 volume, as well as to the Howes Publishing Co. for

SECRETARY'S RECEIPTS, AUGUST 1 TO OCTOBER 23, 1941

Received and Transmitted to Treasurer	*Applications*	*Dues, Regular and Reinstate.*	*Corporate and Sustaining*	*Miscellaneous*	*Totals*
August 1 to September 12, 1941	$85.00	$15.00	$100.00	$94.45	$294.45
September 13 to October 23	255.00	3,678.75	250.00	202.87*	4,386.62
Total in fiscal year	340.00	3,693.75	350.00	297.32	4,681.07
Leaving deposited by Treasurer with Secretary					$500.00

Miscellaneous Items*

Year Books	$108.90	Reprints	2.20
Crock cloth	2.00	Moth Cloth	43.00
Dyed standards	16.00	Knitted tubing	9.20
Reporters	21.57		$202.87

publishing with financial profit to the Association. It was decided that the next Council meeting be in Boston in January.

To Corporate membership were elected Julius Forstmann & Co., Poughkeepsie Dyestuff Corp., Sagamore Color & Chemical Co., and Zinsser & Co. Each of the following was elected to the class of membership specified, as of thirty days from publication of application, provided no objection be received meanwhile by the Secretary.

Senior

F. C. Atwood	E. C. Lafferty	W. T. Stevenson
G. M. Birk	H. R. Lee	E. H. Suessmuth
L. S. Converse	R. T. Mallory	F. E. Tracy
L. Dietrich	R. H. Morris, III	S. T. Tracy
F. L. Friedrich	H. I. Mueller	E. I. Valko
R. M. Garratt	J. E. O'Malley	C. G. Williams
G. B. Harvey	B. B. Scantland	J. T. Yates
W. T. Jones	E. J. Stelpstra	

Junior

R. G. Betts	A. F. Felgendreger	R. E. Willett
F. L. Ekstrand	B. Laven	

Associate

K. S. Lord	M. Michel	S. P. Taylor
J. H. Maloney	J. W. Quinn	

Student

G. Alperin	T. J. Gillick, Jr.	G. F. Richardson
J. de Basterrechea	C. L. Hedrick	R. E. Stafford
I. F. Brilliant	J. E. Hirn, Jr.	P. H. Sullivan
R. L. Bullock	J. W. Merrill	E. D. Wielicka
M. P. Coulman	J. F. Murphy, Jr.	

A. F. McLean was transferred to Senior membership.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary*.

ONE HUNDRED AND TWENTY-EIGHTH MEETING OF THE RESEARCH COMMITTEE

THE 128th meeting of the Research Committee followed the Council meeting in Pinehurst, N. C., on Friday morning, October 31, 1941. Present were Chairman Louis A. Olney, presiding, G. L. Baxter, K. H. Barnard, E. C. Bertolet, P. N. Collier, H. D. Clayton, C. Z. Draves, R. E. Derby, W. Ebersold, A. Eavenson, D. Ferguson, A. H. Grimshaw, A. E. Hirst, W. E. Hadley, A. P. Howes, N. A. Johnson, E. H. Killheffer, D. P. Knowland, W. R. Moorhouse, G. A. Moran, A. R. Macormac, W. Macia, C. L. Nutting, R. W. Philip, R. E. Rose, C. H. A. Schmitt, J. Shanks, T. R. Smith, C. A. Seibert, H. W. Stiegler, Ben Verity, P. J. Wood, and H. C. Chapin, Secretary.

The Chairman and Mr. Ryberg reported on recent activities of the Committee, especially on the testing of olive drab dyeings on wool for uniforms. Mr. Seibert reported further on the tentative test for fastness to chlorine. Mr. Macia reported for Mr. Marks' committee on Shrinkage of Rayon Fabrics. Dr. Stiegler reported for the committee on Water Resistance of Fabrics, with particular reference to Federal Government specifications. Mr. N. A. Johnson was appointed a member of the Research Committee.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary*.

MEETING, SOUTHEASTERN SECTION

ROBERT J. McCAMY, Superintendent of Dyeing, Pepperell Mfg. Company, Lindale, Ga., was elected chairman of the Southeastern Section at the Section's annual meeting in Atlanta on Saturday, December 6th. He succeeds as chairman, Perrin N. Collier, Vice-President and Director of Research, Callaway Mills, LaGrange, Ga. Mr. Collier was made national councilor for the Section, succeeding Robert W. Philip, editor of *Cotton*, Atlanta.

Russell Gill, Vice-President, Southern Sizing Company, Atlanta, was made Vice-Chairman of the Section, succeeding L. L. Bamberger of Lanett Bleachery & Dye Works, Lanett, Ala. T. A. Davis, Superintendent of Dyeing and Bleaching, Muscogee Mfg. Company, Columbus, Ga., was made treasurer, succeeding A. R. Macormac of Alabama Polytechnic Institute. Lee L. Baker, Director of Research, Tesco Chemical Company, Atlanta, Ga., was made Secretary, succeeding Curt Mueller, Superintendent of Dyeing and Polishing, Bibb Mfg. Co., Macon, Ga.

Four members were re-elected to the Sectional Committee: J. W. Richardson, Superintendent of Bleaching, Rus-

LEFT TO RIGHT—Perrin N. Collier, retiring Chairman and Councilor-elect; Samuel J. Davis; George H. Small, elected to Sectional Committee.

Chairman-Elect Robert J. McCamy, left, chatting with Walter M. Scott. Perrin N. Collier at far right.

These photos were taken at the last meeting of the Southeastern Section by George E. Missbach.

Lee L. Baker, left, Secretary-Elect, and Curt Mueller, retiring Secretary.

sell Mfg. Company, Alexander City, Ala.; John P. Harrison, Superintendent, Muscogee Mfg. Company, Columbus, Ga.; M. T. Johnson, Superintendent of Dyeing, Callaway Mills, LaGrange, Ga.; and George E. Missbach, F. H. Ross & Company, Atlanta, Ga.

The following four new members were named to the committee: Paul M. McLarty, Thomaston Bleachery, Thomaston, Ga.; L. E. Whittelsey, Southern Dyestuff Corporation, Macon, Ga.; Walter H. Jackson, National Aniline & Chemical Co., Columbus, Ga.; and George H. Small, National Oil Products Company, Atlanta, Ga.

In the technical session at the meeting, Professor C. A. Jones, Dean of the A. French Textile School at the Georgia School of Technology, presented to the Section the paper on "Preparation and Processing of Domestic Flax," which was this Section's entry in the annual contest at the national convention at Pinehurst in October, receiving one of the prizes awarded in that contest.

Dr. Karl Reiland, former Rector of St. George's Episcopal Church, New York City, delivered an inspirational address.

Respectfully submitted,

Lee L. BAKER, *Secretary.*

MEMBERSHIP CARDS

have been mailed

by the Secretary

in acknowledgement of

Dues Payments

received through

December 15th

MEMBERSHIP APPLICATION BLANKS

for individual and corporate membership

can be obtained from the

SECRETARY OF THE ASSOCIATION

LOWELL TEXTILE INSTITUTE, LOWELL, MASS.

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the American Dyestuff Reporter any vacancies which may occur in their business.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

NOTICE TO EMPLOYERS

Personal Histories and Employment Records of the following applicants are on file at the office of the American Dyestuff Reporter. Prospective employers may examine them without obligation.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

A-1

Education—Graduate textile chemistry and dyeing course, Lowell Textile Institute, 1932. Special course in colloid chemistry at M.I.T.

Experience—Library work in spare time while attending school; five years as assistant chemist with knitting mill, duties consisting of testing and grading silk, testing of oils, soaps, dyes, finishes and other chemicals, making up specifications for various lines of hosiery and checking finished product, keeping a check on production costs, control of waste and irregulars, checking competing products and carrying on research to improve product and reduce costs. Woman; age 30; references.

A-2

Education—B.T.C., Lowell Textile Institute, 1933.

Experience—Textile chemist, cotton and rayon thread; agricultural chemist, protein, fat and mineral analysis; special Federal inspector on textiles, New York City; U. S. inspector, war department; chemist-spotter, dry cleaning experience. Age 32; married.

A-3

Education—B.S. in chemistry, Lehigh University.

Experience—Experimental engineer and analytical chemist, 8 mos.; assistant superintendent of silk corporation, assisted in planning and directing production, in charge of laboratory, technical work, personnel, purchasing, etc., 2 years; inspector of ordnance material, to the present. Seeks position as chemical engineer or chemist.

Age 25; single; references.

A-B-9

Education—Textile School Graduate; Alexander Hamilton Institute Business Course.

Experience—Mature, executive type of textile chemist and colorist with over twenty years' broad general experience in factory, laboratory, purchasing and all around business procedure. Good correspondent. Excellent personality. Wholesome appearance. Fine speaker. Literary and artistic ability. Real color sense. Possesses fund of factual information about material things in a wide range of industries. Capable of meeting the highest type of clientele and planning and directing the efforts of all types of personnel. Desires supervisory, contact, promotional or sales work. Willing to prove ability and versatility.

Age 44; American born; New England Yankee ancestry; married.

A-B-16

Education—3 years analytical textile chemistry and 2 years textile dyeing at Rhode Island School of Design.

Experience—6 years assistant research chemist at cotton finishing plant. Had charge of putting all research into production; complete study of starches, dextrines, gums, resins, finishing oils, softeners and sulfonated oils; considerable microphotography experience; wash and light tests on dyestuffs; knowledge of all cotton finishing operations; experience in water treatment; recent experience as dyer of wool, cotton, rayon (stock and piece goods), and mixtures. Seeks position as chemist, dyer or laboratory technician.

Age 30; American; married; references.

A-B-17

Education—Graduate of Franklin Union and Lowell Textile Institute, 1942.

Experience—1936 until present as assistant dyer in hosiery dye works. Experienced on full fashioned and anklet hosiery, handling wool, cotton, silk, rayon and nylon and combinations; has charge of weighing dyestuffs, testing and shade matching; experience with hosiery dyeing machines of all sizes. Seeks position as assistant dyer or laboratory technician.

Age 24; married; references.

A-B-18

Education—Graduate Philadelphia Textile School, 1940.

Experience—Has experience as assistant chemist and trouble shooter in silk dyeing and finishing plant; as manager of laundry store; and as printer and colorist in screen printing plant. Seeks position in laboratory and research, dyeing, printing or finishing.

Age 21; single; references.

A-B-C-F-3

Experience—Broad experience since 1906 as overseer of finishing, general researcher, trouble shooter, overseer of dyeing, general superintendent, mill manager. Experienced in woolen, worsted, cottons, unions and mixtures. Recently specialized in men's wear cottons. Seeks position as overseer of finishing or dyeing, assistant superintendent, superintendent or manager.

Age 53, married; references.

A-C-D-1

Education—Chemistry, Temple College, Philadelphia, evenings. Dyeing and textile chemistry, Philadelphia Textile School.

Experience—Employed about 18 years in textile mill, becoming chemist; 5 years as superintendent of finishing on silk and rayon ribbons; 10 years as salesman of chemicals and textile specialties in eastern Pennsylvania and parts of New Jersey; has some knowledge of the processing of all textiles. Seeks position as salesman with well known company.

Age 48; married.

B-10

Education—2 years chemistry, 2 years textile chemistry and dyeing, Lowell Textile Institute, evenings.

Experience—4½ years dyeing and bleaching hosiery, specializing in children's and infants' hose; 3 years assistant dyer, dyeing and bleaching cotton, mercerized and unmercerized, wool, wool-cotton, wool-rayon and wool-silk hose. Seeks position as second hand, assistant dyer or laboratory assistant in hosiery mill.

Age 27; single; references.

AMERICAN
DYESTUFF REPORTER

A. P. HOWES
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Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

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1942

AS we cross the threshold into a new year it is customary for editors generally to attempt an appraisal of the good and evil of the old and a forecast of the hopes and fears for the new.

At this particular season, and upon cursory examination, there would seem to be very little in the outlook for the coming year which one could approach with any sense of satisfaction. The past year certainly has been one of hectic activity, fraught with all manner of economic and social upheavals occasioned by war activities. The new year will undoubtedly see a magnification of all of these disturbing influences, since our country is now not only faced with involvement but is actually involved in a struggle which threatens its very existence.

However, it is not the American way to become unduly disheartened because of the appearance of seemingly insuperable obstacles on the immediate horizon — rather is it our faculty to examine and assess these obstacles at their true worth, however great, and immediately set about the development of ways and means by which to surmount or circumvent them. And so far, in our national existence, the ways and means developed have been in every instance adequate to accomplish the results desired.

In order to obtain a clearer insight as to what the future may hold for the United States it may be cheering to compare the conditions of 1917, when the United States became involved in the last World War, with those presently existing.

Insofar as the textile industry is concerned, it will be recalled that in that earlier period the entire elimination of the importation of German dyestuffs, on which the industry had been almost totally dependent, had left it in a condition where almost any sort of coloring material was used for any purpose. There was no such thing as uniformity or a guarantee of fastness.

The newly born American dyestuff industry had only begun to produce the most ordinary colors and the scanty stocks of pre-war dyes were adulterated and sold at prohibitive prices. Yet that infant American dyestuff manufacturing industry, born of necessity and hailed by all save a few zealots as a makeshift bound for speedy extinction as soon as German competition was resumed, has grown into one of the strongest industries in the nation and stands to-day as one of our chief assets in the all-out struggle against totalitarian militarism.

For not alone is the productive capacity of this synthetic chemical manufacturing industry vital to the supply of munitions of war, but its laboratories have served as training schools for a countless number of research chemists who have found their way into any number of manufacturing fields where they have supplied the chemical control so essential to the development of large scale industry of every type.

It is also worthy of note that the year of United States entry into the last war, 1917, saw the birth of the AMERICAN DYESTUFF REPORTER. Except for that war we certainly should never have been in existence, as our function at that time was not the dissemination of technical information regarding the application of dyestuffs, but was purely one of propaganda on behalf of the newly born American dyestuff industry, whereby we endeavored to persuade textile consumers to bear with patience the fumbling efforts of the infant industry to supply their needs.

And had the REPORTER never been born, we, at least, should not have undertaken the promotion of a scientific textile-chemical society which came to be the American Association of Textile Chemists and Colorists, and it is probable that the organization of a body of this kind would have been delayed many years or possibly might not have come about at all.

It is a truism that only out of suffering and travail are the most really worthwhile world developments born. One thing is certain, our country is on the threshold of a period of hardship, the end of which no man at the moment may forecast. Certain it is that we shall be compelled to pay to the fullest with both life and property in order to preserve our democratic way of life. But that we shall ultimately be successful in so preserving it, none of us for a moment doubts. And, in the light of past experience, it is also reasonable to believe that out of the throes of our struggle for its preservation, will eventually materialize blessings of which at the moment we have no conception.—A. P. H.

TRADE NOTES • NEW PRODUCTS

OBITUARY

JAMES A. BRANEGAN

JAMES A. BRANEGAN, president of the Kali Manufacturing Co., died on Tuesday, December 23rd, 1941, at his home in Drexel Park, Pa. He was 70 years old.

Mr. Branegan, who started in the chemical industry in 1888 and had been in it all his life, was widely known in this field. He was particularly well known to many through his book "Popular Industrial Chemistry."

He was born in Brooklyn, N. Y., and was a graduate of Pratt Institute. For 25 years he was associated with the General Chemical Company in New York and Philadelphia. In 1914 he was a founder of the firm which he headed for many years as president. During the first World War he was a chemical director for the alien property custodian.

Mr. Branegan was a contributor to many textile publications and was a member of the American Association of Textile Chemists and Colorists. He was also a member of the American Chemical Society, the Society of Chemical Industry of England, the Chemists' Club in New York and the American Leather Chemists Association.

He is survived by his wife and a son, James A. Branegan, Jr.

• APPOINTED TO OPM

Appointment of Harry Dalton, Charlotte, North Carolina, as Rayon Consultant in the Textile, Clothing and Equipage Branch, Division of Purchases, OPM, was announced recently by R. R. Guthrie, Assistant Director of Purchases. Mr. Dalton has been associated with the Hunter Manufacturing Company. He is a director of the R. S. Dickson Company, Carlton Yarn Mills, the Shaw Manufacturing Company, and of the American Viscose Company.

Mr. Dalton attended Duke University and did post-graduate work in New York University.

• CHEMISTRY OF THE CHLORITES

Research chemists of Mathieson Alkali Works brought the obscure chemistry of the chlorites up to date in a paper presented at the meeting of the Division of Physical and Inorganic Chemistry of the American Chemical Society, held at Columbus, Ohio, December 31. The authors of the paper were James F. White, Maurice C. Taylor, and George P. Vincent.

Methods of preparing chlorites were described, and the analysis of solutions containing mixtures of hypochlorites, chlorides, chlorites, and chlorates, with their decomposition products, were discussed. It was pointed out, however, that the analytical methods at present employed are unsatisfactory and that further research in this field is desirable.

The various reactions that take place when chlorites decompose were discussed and their end products were given, but it was pointed out that, due to analytical uncertainties, little definite information as to the intermediate stages has as yet been accumulated.

Especially, the exact oxidizing agent responsible for the special bleaching action of sodium chlorite has not as yet been determined, the author states, but existing evidence points to the chlorite ion rather than to chlorine dioxide.

Methods of preparing chlorine dioxide from chlorites were described, and precautions to be taken to prevent explosions of this unstable gas were outlined.

The paper closed with a review of the present uses of chlorites which include bleaching wood pulp, cotton, rayon, and cane sugar syrup.

• CANADIAN BRANCH, HART PRODUCTS

The Hart Products Corporation of New York has announced the formation of a Canadian branch which will be known as The Hart Products Co. of Canada, Ltd., with headquarters at Guelph, Ontario. A fully-equipped plant and laboratories will serve the Canadian textile industry with a complete line of processing agents. The Canadian office will be in charge of Emanuel I. Birnbaum and Charles Humphrey. Mr. Humphrey was formerly with Onyx Oil & Chemical Co.

• CALCO RELEASE

Calco Chemical Division of the American Cyanamid Company announces a new dyestuff called Calcochrome Yellow NFC. It is a chrome yellow especially recommended by the manufacturers for use in formulations for the standard Government shades on wool.

The outstanding characteristics of this color are said to be its fastness to carbonizing, excellent fastness to light and very level dyeing properties. The degree of these characteristics is well within the limitations specified for Government use.

Copies of the announcement showing the general properties, mounts and application methods are available on request.

• DCAT ELECT OFFICERS

The organization meeting of the newly elected Executive Committee of the Drug, Chemical and Allied Trades Section of the New York Board of Trade was held on Thursday, December 4, at the Drug and Chemical Club, 85 John Street. The primary purpose of this meeting was the election of officers to serve for the next fiscal year, the results of which follow: Chairman, S. Barksdale Penick, Jr. Executive Vice-President of S. B. Penick & Company; Vice-Chairman, Victor E. Williams, Eastern Sales Manager, Monsanto Chemical Company; Treasurer, Robert B. Magnus, Vice-President of Magnus, Mabee & Reynard, Inc. (re-elected). Carl M. Anderson, Assistant Secretary, Merck & Co., Inc., was re-elected Counsel, and John C. Ostrom was re-elected Secretary.

The retiring Chairman, John J. Toohy, Manager of Distribution for E. R. Squibb & Sons, Inc., automatically becomes a member of the Section's Advisory Council, to succeed James C. Chilcott, President of The Maltine Company.

Plans for the forthcoming 17th Annual Banquet to be held in March were discussed and announcement will shortly be made concerning committees in charge.

• CONVERTIBLE TOP DYE

The Mercury Corp. of Kansas City, Mo., has been appointed the distributor of Aridye colors for re-dyeing faded convertible auto tops, according to an announcement made by the Aridye Corporation, Fair Lawn, N. J. The product will be sold by the Mercury Corp. under the name "Converto Dye."

• STAINLESS STEEL GUIDE

A brochure prepared as a guide to engineers planning the purchase of stainless steel processing equipment has been issued by S. Blickman, Inc. of Weehawken, New Jersey, specialists in the fabrication of stainless steel processing equipment up to ⅜" thick.

Entitled, "What to Look for When You Specify Stainless Steel Processing Equipment," the brochure has sixteen pages of practical information which will help engineers select a grade of stainless steel, determine the proper finishes for various types of processing equipment, and plan for designs which reduce the cost of equipment and at the same time conserve steel. The Blickman booklet also includes special information on round corner construction in processing vessels and facts about welding techniques.

The book will be sent free to engineers and executives in the processing industries by S. Blickman, Inc., Weehawken, New Jersey.

• MEETING, S.O.C.M.A.

The twentieth annual meeting of the Synthetic Organic Chemical Manufacturers Association of the United States was held at the Chemists' Club, New York

City, on Tuesday evening, December 9th.

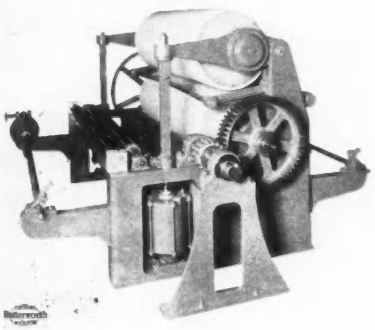
A dinner followed the meeting at which many guests were present. The speaker of the evening was Strickland Gillilan, humorist. Arrangements were made to hear the address of the President of the United States which was broadcast at 10 P.M.

The next monthly meeting of the Association will be held on Tuesday, January 13th, 1942.

• BUTTERWORTH 2-ROLL PADDER

Results now available on the performance of a Butterworth 2-Roll Padder with air cylinders are said to confirm the predictions made for it. The new machine, designed for the dyeing of rayon, is said to be producing deeper shades than ever before possible at a speed range of 15 to 45 yards per minute.

It is stated that controlling pressure with air cylinders has proved remarkably effective. The operator can always arrive at the same shade when using the same formula. Should there be any difference in the construction of a fabric from one side to another, the pressure can be increased or decreased on either side at will.



2-Roll Padder with Air Cylinders

The machine has a capacity of 10,000 lbs. on each side which would give a maximum pressure of 10 tons on the nip. It is equipped with a panel containing necessary recording instruments for applying or releasing pressure. Cloth is delivered from the Padder with a minimum amount of moisture, thus speeding the drying operation.

The machine has two large rubber covered rolls. The large diameter of the rolls guards against deflection. The special stainless steel liquor box has the necessary threading-up rolls and breast rolls. It is designed principally for rayon but can be used for certain other types of cloth without change. The machine is equipped with a balanced friction let-off at the entering side and a slip belt winder at the delivery side. There is a choice of 3 drives: (1) Directly connected motor to bottom roll; (2) Geared motor through V-belt; (3) from motor through variator to jack shaft.

• ANNUAL MEETING, A.S.A.

"Standardization is going forward in this country at a rate never reached before," said R. E. Zimmerman, president of the American Standards Association at its annual luncheon meeting on December 10th. Three hundred representatives of trade, technical, and governmental groups who hold membership in the American Standards Association gathered at the Hotel Astor, New York, to hear Mr. Zimmerman and J. Lessing Rosenwald, head of the new Bureau of Industrial Conservation of the OPM and R. P. Anderson, chairman of the Standards Council of the American Standards Association.

All three speakers dwelt on the part that the Association is playing and can play in the country's defense program. "This entire defense effort," said Mr. Zimmerman, "has been seriously hampered by the diversity of specifications and requirements for products—acutely so in the case of strategic materials.

"What a boon it would have been to the industries of this country if at the beginning of the defense effort we had had, 5,000 good, seasoned American Standards instead of five hundred! Many a manufacturer who is today facing a shut-down as a result of the defense program through lack of scarce materials would have been able to carry his full part in production had we had a full complement of American Standards to which our manufacturers, big and little, were accustomed to working."

Commenting upon some of the work specifically dealing with defense needs, Dr. Anderson said: "Last January, the Association seeing that it would be called upon for special services, adopted a short cut emergency method of developing standards needed for defense. This action was related to that of the British and Australian associations, both of which have been issuing defense emergency standards under a similar procedure. Four such standards have already been developed. One provides a series of tests for the accuracy of engine lathes, one of the most important tools of defense production. Two others cover control of quality in mass production, thus helping the manufacturer spot trouble before that trouble becomes bad enough to cause rejection of his product by the inspection department. The fourth completed emergency standard sets up safe concentration limits for cadmium, which constitutes a hazard in certain defense plants. A dozen additional emergency standards are in the process of development.

"Still along the lines of defense, the American Standards Association has been requested by the Office of Price Administration to undertake four projects, three of them for commonly used household appliances like refrigerators. The purpose of these particular jobs is to assure the public of the quality of these products in the face of shrinking supplies of raw materials and to conserve production space needed for war orders.

"A proposal has just been made for standards for flood-lighting of defense plants, in order to reduce risk of fire and theft, and to make night work possible as well as safer.

"I believe that one of the most important jobs, perhaps the most important job for the association during the coming year lies in its program of Defense Emergency Standards."

In line with the increased interest in standardization, Mr. Zimmerman welcomed five new national organizations into the membership of the Association:

The American Institute of Steel Construction
The Association of Gas Appliance and Equipment Manufacturers
The National Lime Association
The Metal Lath Manufacturers Association
The American Hotel Association

All of these with the exception of the Hotel Association are already active in ASA work. The new members make a total of 77 national organizations holding membership. "It is interesting to note," said Mr. Zimmerman, "that the Association started twenty-three years ago with a membership of five engineering societies—later on broadened to include some trade associations in the heavy industries—and that nearly all of the early work consisted of interchangeability of parts, and of specifications for materials. In the years since then, many new groups have become interested in standardization work. These have brought to the Association jobs in the mining field, in civil engineering and building, and in many other fields. As I look through the projects we are working on today, I find traffic standards, safety standards, standards for the prevention of industrial diseases, for photography and cinematography, and standards in many other fields of work.

"Recently we have made another big departure from the work with which we started twenty-three years ago, in undertaking the development of a whole series of standards for consumer goods.

"Connected with this work a proposal has come to the Association that in addition to its standardization work on consumer goods it develop a program on certification of products as conforming to standards. The suggestion is that the Institute of Standards which was organized for the certification of consumer products should be merged with the American Standards Association. The Board has authorized a study of the subject.

"The war has, of course, disrupted international cooperation in standardization work. It has, however, greatly stimulated interest in Inter-American cooperation in

standardization work. Such cooperation offers an effective means of improving trade relations from which both the Latin American countries and the United States would benefit.

"A special committee of the Association appointed to consider the whole question of Inter-American cooperation recommends a broad program which would include: the exchange of information and material with all Latin-American organizations doing significant standardization work, arrangements for translation of standards into Spanish and Portuguese, and intimate cooperation with each country in the development of its standards.

"Senor Ceriale, director of the national standardizing body of Argentina, has accepted an invitation to visit the United States as a guest of the American Standards Association. This visit, which is to take place in the early part of the year, will give Sr. Ceriale a chance to study at first hand the development of American industrial practices and standards. Arrangements will be made for him to visit the major manufacturing centers of the country."

● ELECTED TO A.A.A.S.

Dr. Camille Dreyfus, president of Celanese Corporation of America, has been elected a member of the American Association for the Advancement of Science, it was disclosed recently.

Dr. Dreyfus has many scientific achievements to his credit, having been a pioneer in the commercial development of cellulose acetate for use in the textile and plastics field.

● LOW GRADE COTTON FOR PAPER

Fine bond and writing papers, which have always been made from cotton rags, can now be made from such cotton by-products as hull shavings and the waste from ginning, carding, and other cotton cleaning operations, according to an announcement by E. O. Reed, of Crane & Company, paper manufacturers of Dalton, Massachusetts.

"Due to the limited supply of suitable rags for making fine paper, the paper-making industry has long sought a practicable method of making paper direct from raw cotton fibers," said Mr. Reed. "Efforts in this direction have heretofore failed, however, because no way could be found to clean the fibers without using chemicals that weaken them and make them unfit for paper manufacture.

"This problem has now been solved by research work that was carried on jointly by The Mathieson Alkali Works, Inc., of New York and Crane & Company," Mr. Reed explained.

The new commercial chemical, sodium chlorite, recently developed by the Mathieson organization, has made this application possible, according to Mr. Reed. It is stated that it was found that when even the most discolored cotton fibers were boiled with this chemical in combination with certain others, and then bleached, the resulting pulp was entirely clean and produced paper in every way equal to the best quality of paper made from cotton rags.

The new process will make possible a wider use of high-grade papers. Mr. Reed said, and will also open up a new market for certain cotton by-products now of little value.

● INCO MAKES PROMOTIONS

Three new assistants to J. F. McNamara, Monel Sales Manager, have been announced by The International Nickel Company. They are W. J. Calnan, H. D. Tietz, and E. A. Turner. At the same time H. E. Searle, formerly an assistant to Mr. McNamara, as Manager, Engineering Sales, for the Monel Department, has been transferred to the Nickel Sales Department under R. L. Suhl, Sales Manager.

E. A. TURNER

The titles of Manager, Engineering Sales, and of Manager, Sales Promotion, the latter held by H. D. Tietz, have been abolished. Each of the new appointees will be Assistant to the Sales Manager.

C. J. Bianowicz becomes head of the Chemical Section of Monel Sales to succeed E. A. Turner.

● DEFENSE COURSE

E. W. Ruggles, Director of the defense training courses conducted at North Caroline State College under the supervision of the United States Office of Education, announces that the fourth course of Fabric Testing and Inspection will begin on February 2 and run for 12 weeks. All expenses except board, room rent, and books are paid by the Federal Government.

Students who enroll in this course will be taught elementary textile design, fabric analysis, fabric calculations, structure and analysis of knit goods, the care and operation of fabric testing equipment, physical and chemical tests for the identification of fibers, as well as a study of yarn and fabric defects.

Mr. Ruggles says that this is an excellent opportunity for high school graduates who are now engaged in the manufacture or distribution of textile products to lay the foundation for future advancement in textile establishments, and possibly to qualify for government service in the Quartermaster Corps as fabric inspectors.

Enrollment in the course is limited to 22 and applications should be made as early as possible to Mr. E. W. Ruggles at State College Station, Raleigh, North Carolina.

● PERKIN MEDAL AWARD

The thirty-sixth impression of the Perkin Medal, awarded annually by the American Section of the Society of Chemical Industry for outstanding work in applied chemistry, will be presented to Dr. Martin H. Ittner of the Colgate-Palmolive-Peet Company, at a meeting at The Chemists' Club, 52 East 41st Street, New York City, on January 9, 1942. This is a joint meeting with the American Chemical Society, American Institute of Chemical Engineers, The Electrochemical Society and Societe de Chimie Industrielle. Dr. Lincoln T. Work will preside.

The program is as follows:

The Personal Side of the Medallist—Sidney D. Kirkpatrick.

The Accomplishments of the Medallist—Dr. Forster Dee Snell.

Presentation of Perkin Medal—Dr. Marston T. Bogert.

"Forty-five Years of Chemistry in a Soap Plant"—Dr. Martin H. Ittner.

A dinner in honor of Dr. Ittner will be held at the Club preceding the meeting, starting at 6:45 P.M.

● ELECTRICAL DEVELOPMENTS

According to the General Electric Co., progress in electric equipment for textile mills has been somewhat retarded by the requirements of the Defense program, but several notable developments have been brought to a successful conclusion during 1941. Among these are said to be: the excellent operation of the constant-tension drive on Duo Dyeing machines; a new control for weft straightening; a new range-speed control valve for turbine-electric range drives; Thy-mo-trol, a new compact electronic motor control; a low-price electric tachometer for indicating a wide range of operating speeds in textile finishing and a new rayon motor for large packages.

It is stated that some of these developments are already contributing directly and indirectly to our national defense efforts through the increased production and better quality products they are making possible.

COMMUNICATIONS RE:

The Role of Cystine in the Structure of the Fibrous Protein, Wool

From J. B. SPEAKMAN, D.Sc., F.I.C., F.T.I.

Professor of Textile Industries, University of Leeds, England

IN a recent paper[1] under the above title, Patterson, Geiger, Mizell and Harris discuss the formation of stable bis-thioether cross-linkages in wool fibers by a two-stage process which involves:

(a) treating the fibers with thioglycollic acid to reduce the cystine linkages to cystine side-chains:—
$R.S.S.R. + 2\ HS.CH_2.COOH = 2R.SH + (S.CH_2.COOH)_2$, and

(b) linking the cystine side chains by reaction with suitable dihalides:—
$2\ R.SH + (CH_2)_3Br_2 = R.S.(CH_2)_3.S.R. + 2\ HBr$.

Fibers treated in this way are shown to possess an increased resistance to alkali, and the authors conclude their paper with the following observations: "Susceptibility to degradation by alkali, which has been one of the most important practical disadvantages of wool, can now be overcome to a large extent through conversion of relatively unstable disulfide cross-linkages to extremely stable thioether cross-linkages. The stability of wools of this sort, under a variety of conditions of practical interest, is now being investigated in this laboratory."

Harris and his collaborators appear to be unaware that two-stage processes of the above type have been in commercial use since 1935 for the purpose of conferring alkali resistance on animal fibers, as well as for setting strained fibers and fabrics at low temperatures. They may be interested in the following quotation from one of the relevant patent specifications[2]. "The invention consists in giving a desired permanent form to fibrous substances containing keratin, such as wool or hair, by treating the substance with a reducing agent to effect relaxation of the fiber structure by disruption of the constituent disulfide or cystine bond of keratin, and thereafter giving permanence to the desired form of the substance in the relaxed condition, and while maintaining it in the said form, with a solution of a polyvalent metal salt or compound, *or with an organic compound containing two or more reactive halogen atoms, whereby to form in or between the fiber molecules sulfur bonds containing a metal or organic grouping.*" Elsewhere in the specification it is stated that "the invention may be applied to improving the resistance of keratins such as fabrics or yarns to deterioration by alkalies and alkali sulfide solutions, apart altogether from the application of a permanent set."

The second method of preparing alkali-resistant fibers referred to in the above specification, viz., by treating the reduced fibers with metal salts so as to form —S—X—S—bonds, where X is the metal, has received consideration in a number of papers[3]. Contrary to Harris' statement, such linkages are not necessarily ionized, especially when the metals possess marked coordinating power. They have, indeed, been used with success to prevent the unlevel dyeing of wool staples or cloth which has been exposed unevenly to the action of light, alkalies and similar agencies[4]. Finally, related, non-ionized, metal-containing linkages have been employed recently in the synthesis of alkali-resistant rayon from seaweed in these laboratories[5].

REFERENCES

[1]Patterson, Geiger, Mizell and Harris, Amer. Dyestuff Rep., 1941, *30*, 425.

[2]Speakman, British Patent No. 453,701, 1936 (Application date—1934).

[3]Speakman and Whewell, J. Soc. Dyers and Colourists, 1936, *52*, 380; Speakman, *ibid.*, 1936, *52*, 423; Speakman, Stoves and Bradbury, *ibid.*, 1941, *57*, 73; Speakman, J. Text. Inst., 1941, *32*, T83.

[4]Race, Rowe and Speakman, J. Soc. Dyers and Colourists, 1938, *54*, 159.

[5]Lecture to the West Riding Section, Society of Dyers and Colourists, November, 1940.

* * *

From MILTON HARRIS and WALTON B. GEIGER

Textile Foundation, Washington, D. C.

IT has long been known that the sulfur linkages of wool form a primary point of attack by alkalies and that their lability, to a large extent, accounts for the ease of degradation of wool by these reagents. The desirability of stabilizing these linkages is obvious, and with this in mind, an extensive investigation of the factors relating to the alkali degradation of wool was started in this laboratory about eight years ago. Publication of the present phase of our work has been delayed for several years for practical reasons.

During this development we were not unaware of the publications of Speakman, and in the course of the investigation, a large number of wool samples of the type described by Speakman[2, 3] were prepared and studied along with those prepared by our procedures[1]. Since they shared none of the desirable qualities of our own products, especially as regards stability towards alkalies, there seemed to be little point in discussing them in our earlier paper. The communication by Speakman now makes it necessary to emphasize a number of fundamental differences between our method and his. The properties of the products prepared by the two methods further emphasize these differences.

First, there is a fundamental difference between the reduction methods in the two procedures. Our method[1] consists in reducing wool with a mercaptan, such as thioglycolic acid, thus converting each disulfide group to two sulfhydryl groups as follows:

$$R—S—S—R + 2\ HSCH_2COOH \rightarrow 2\ RSH + (SCH_2COOH)_2 \quad (1)$$

Speakman's method[2, 3] consists in treating wool with inorganic reducing agents such as mixtures of sodium sulfite and sodium bisulfite which react as follows: -

$$R—S—S—R + NaHSO_3 \rightarrow RSH + RSSO_3Na \quad (2)$$

It is clear that not more than half of the cross-links broken by his method can be rebuilt by the methods described and even this might be difficult because the sulfhydryl groups thus formed are not in juxtaposition. On the other hand it has been shown that linkages broken by our methods are quantitatively rebuilt.

Second, the treatments utilized for rebuilding the ruptured links are fundamentally different. Our method utilizes aliphatic dihalides to yield the *bis*-thioether types of linkages as follows:

$$2\,RSH + (CH_2)_3Br_2 \rightarrow RS(CH_2)_3\,SR + 2\,HBr \quad (3)$$

Speakman's method consists in treating wool with a metallic salt[2] or with phosgene[3], the sole organic dihalide he mentions. The following reactions would be expected:

$$2\,RSH + Zn\,Cl_2 \rightarrow RS\,Zn\,SR + 2\,H\,Cl \quad (4)$$

$$2\,RSH + COCl_2 \rightarrow RSCOSR + 2\,H\,Cl \quad (5)$$

It may be pointed out that phosgene*, if it reacts according to eq. 5, would yield thioester linkages which would be much less stable toward alkalies (and acids) than the *bis*-thioether linkages formed in our method (eq. 3).

Aside from the foregoing theoretical considerations, the differences in products obtained by the two methods are best demonstrated by the results of actual tests, as shown in Table 1. The products indicated in part A were prepared by the methods described by Speakman[2], and that in part B in accordance with the cited patent[3]. Since no specific directions for the use of phosgene are given, many attempts to use this reagent under a variety of conditions were made in this laboratory, but in every case, products having higher alkali-solubilities than the original wool were obtained. Further, not one product obtained by any of Speakman's published methods was more stable to alkali than the original untreated wool while products having alkali-solubilities as low as one-fourth of the original were obtained by our methods.

It should be pointed out that by using the alkali-solubility test[4], a direct measure of the stability of the products to alkali has been obtained. Further, such tests have been found to correlate well with actual laundering tests. In contrast, Speakman's conclusions concerning the stability of his products toward alkalies are indirect and derived from the ability of "permanently set" fibers to retain their "set" on treatment with sodium carbonate. Such conclusions depend upon a particular theoretical mechanism of permanent set which he has advanced.

In conclusion we should again like to point out that as far as we are aware, this is the first time that hydrocarbon chains have been inserted between sulfur atoms of the disulfide linkages in wool to produce stable *bis*-thioether cross-linkages. Likewise, it is apparently the first time that the properties of such products have been described. In addition to the increased stability toward alkalies, wool containing *bis*-thioether linkages shows increased resistance to attack by enzymes[5], and other biological and chemical agents[6].

*As a result of numerous experiments, it appears very doubtful that phosgene reacts according to eq. 5.

TABLE 1
Alkali-Solubility of Modified Wools Prepared by Various Methods

Reagent Used for Second Step	*Alkali-Solubility Per Cent*
A. Prepared according to Speakman by reduction with bisulfite:	
$ZnSO_4$	14.6
$BaCl_2$	13.8
$Pb(C_2H_3O_2)_2$	13.7
$Cu(C_2H_3O_2)_2$	19.8
$Hg(C_2H_3O_2)_2$	71.5
B. Prepared according to Speakman with bisulfite:	
$COCl_2$	17.8
C. Prepared according to our method:	
$(CH_2)_3Br_2$	2.5
D. Untreated wool:	
——	9.5

REFERENCES

[1]W. I. Patterson, W. B. Geiger, L. R. Mizell, and M. Harris, J. Research NBS *27*, 89, Research Paper 1405; Amer. Dyestuff Reporter *30*, No. 16, 425; Textile Research *11*, 379 (1941).

[2]J. B. Speakman, J. L. Stores, and H. Bradbury, J. Soc. Dyers Colourists *57*, 73 (1941).

[3]J. B. Speakman, British Patent 453,701 (1936).

[4]A. L. Smith and M. Harris, P. Research NBS *16*, 301, Research Paper 875; Amer. Dyestuff Reporter *25*, No. 7, 180 (1936).

[5]W. B. Geiger, W. I. Patterson, L. R. Mizell, and M. Harris, J. Research NBS *27*, 459, Research Paper 1433; Amer. Dyestuff Reporter *30*, 659 (1941).

[6]In preparation for publication.

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JULY	6-20
AUGUST	3-17-31
SEPTEMBER . .	14-28
OCTOBER . . .	12-26†
NOVEMBER . .	9-23
DECEMBER . .	7-21

*Knitting Arts Exhibition, Atlantic City, N. J.

†Annual Processing Review Number, Annual Meeting of American Association of Textile Chemists and Colorists (tentative).

Proceedings of the AATC&C

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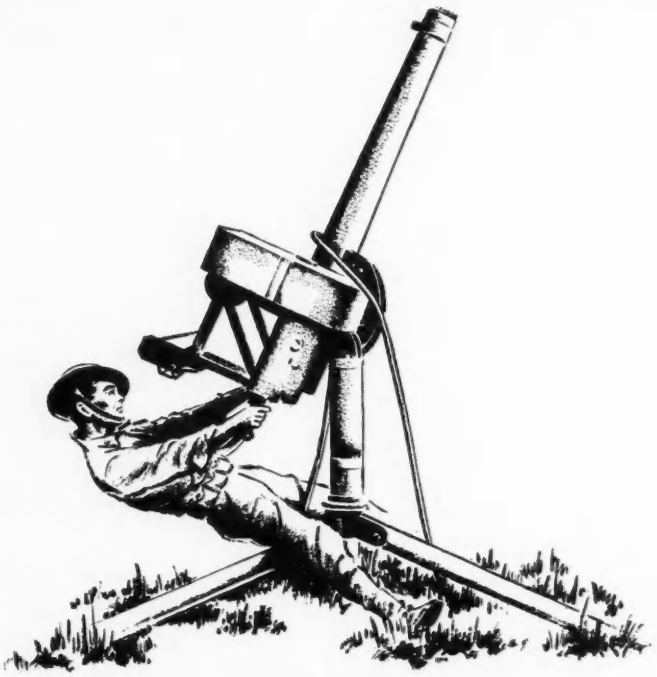

"Let's get this one over in a hurry . . ."

122 years ago our Republic was forty-four years old in its independence—big and raw and just beginning to feel its strength.

122 years ago, H. W. Butterworth established this business to pioneer, develop and supply machinery for the Wet End of the Textile Industry.

For several years the business prospered, serving the needs of mills which in turn supplied the textile requirements of a nation at peace. Then came war. Heavy demands were made on the mills for fabrics and we strove to provide the equipment necessary for a bigger output.

Again peace—again war . . . Again peace—again war . . . Four times in 122 years. Each war has brought heavier demands from Textile Mills—and in war as in peace we have stood by to supply equipment as quickly as possible.

Again it is war—again it is Textiles for Victory! The manufacture of gun mounts has first call on our facilities, but we are still here to help you improve, repair and replace obsolete equipment to the utmost of our ability.

And again we say, "Let us all exert ourselves as we never did before—let's get this one over in a hurry!"

***64%**

of equipment now in use in the wet end of textile finishing cannot operate at a profit in competition with modern machines.

*Proved by Research

H. W. BUTTERWORTH & SONS CO.
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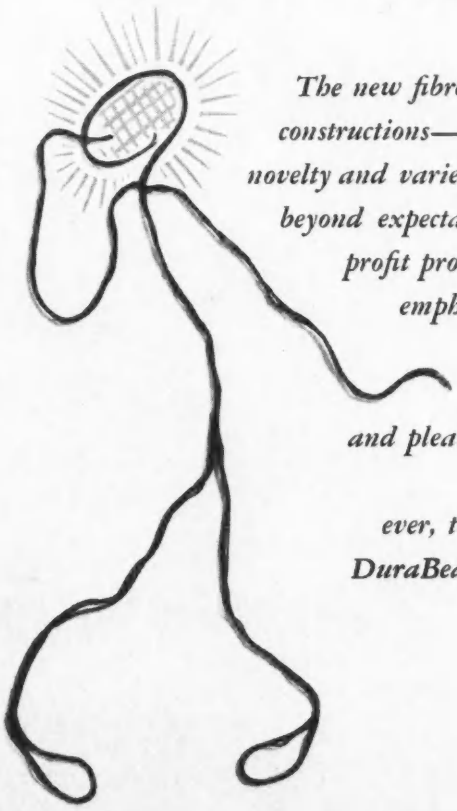
Butterworth

PRODUCING GUN MOUNTS FOR THE UNITED STATES ARMY

"gawsh-

she says I'm pretty!"



The new fibres—in all their new constructions—whose vibrant beauty, exciting novelty and variety, stirred the holiday trade beyond expectations foretell a year of great profit probabilities . . . with emphasis, naturally, on brands that feature fullest measure of enduring beauty and pleasing wear-ability . . . And, it pays now, more than ever, to say the fabric is DuraBeau finished.

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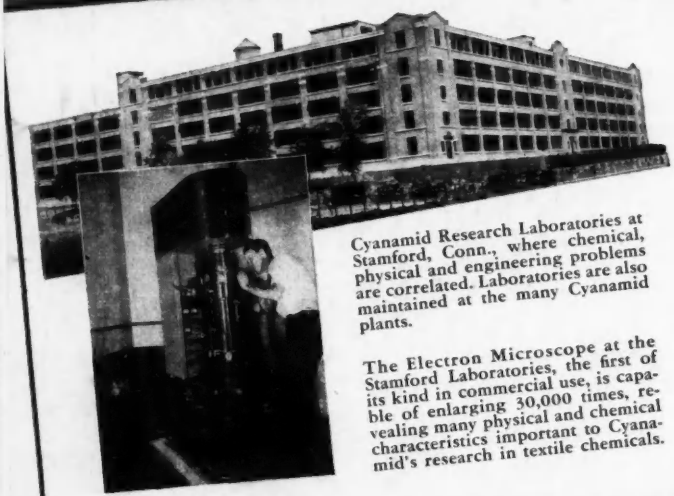
RESEARCH!

THE EXTRA VALUE IN CYANAMID QUALITY PRODUCTS FOR THE TEXTILE INDUSTRY



Cyanamid Research Laboratories at Stamford, Conn., where chemical, physical and engineering problems are correlated. Laboratories are also maintained at the many Cyanamid plants.

The Electron Microscope at the Stamford Laboratories, the first of its kind in commercial use, is capable of enlarging 30,000 times, revealing many physical and chemical characteristics important to Cyanamid's research in textile chemicals.

The extraordinary demands of the times are such as to tax the ingenuity of all industry. The textile industry, too, is faced with additional burdens on its capacities, and problems as to its processes and materials. Only the best is equal to the job to be done . . . and the importance of the proper selection of raw materials to meet the new requirements is greater than ever before.

At Cyanamid, research in textile chemicals, always an important phase of the Company's activities, is directed toward advancing the means and methods of meeting present conditions, and conditions that may be faced in the future. The many chemical specialties Cyanamid supplies . . . sulphonated oils, penetrants, softeners, finishes, sizing compounds, wetting agents and others . . . are subjected to critical examination for ways to improve quality and to broaden their usefulness. New products are developed to meet new conditions and to replace others made unavailable due to the emergency. In this work Cyanamid coordinates the most modern chemical, physical testing, and analytical equipment with the talents of a highly trained laboratory staff . . . a procedure that has succeeded through the years in producing better products at lower costs and many new products of timely application to the needs of users of chemicals in industry.

Cyanamid research is devoted not only to matters of materials but also to methods and equipment as well. Cyanamid's chemists, technicians, and representatives, thoroughly trained in the fields they serve, are prepared to examine, test and counsel in relation to specific conditions in a manufacturer's own plant, and help him solve emergency and "chronic" production problems. In any matter relating to the selection and use of textile chemicals, Cyanamid is "on call" to assist you in the most practical and economical way. There is no obligation.

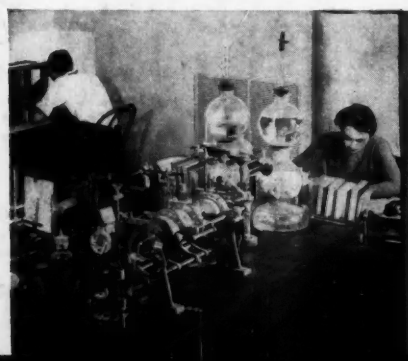
The Launderometer and Heat Curing Box for testing of resin applications are representative of the modern equipment in Cyanamid's Textile Chemicals Laboratory at Stamford.

SULPHONATED OILS; PENETRANTS; SOFTENERS; FINISHES; SIZING COMPOUNDS; DECERESOL* WETTING AGENTS

*REG. U. S. PAT. OFF.

A section of the Physical Testing Laboratory.

A corner of the Micro-Analytical Laboratory.



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